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INTRODUCTION

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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The authority for the indexing vocabulary used in the subject index of this issue of *STAR* is the *NASA Thesaurus*. The most recent version is the *NASA Thesaurus—Alphabetical Update* (NASA SP-7040), September 1971, which is available from NTIS as accession number N72-15923 for $6.00 in paper copy. The current cross-reference structuring for each term appears in this volume, together with additional approved terms that may be used in indexing documents announced in other issues of *STAR*. NASA SP-7040 supersedes the first two volumes (subject terms A–Z) of the three-volume *Preliminary Edition of the NASA Thesaurus* (NASA SP-7030), December 1967. Volume III of the Preliminary Edition presented the following aids to vocabulary selection of the 1967 terms: hierarchical display of index terms, category terms listing, and permuted index; this has not been updated but may still be useful.

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02 Aircraft 2218
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 2224
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 2229
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 2234
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 2248
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 2248
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 2250
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 2258
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 2299
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 2303
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

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Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

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Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 2311
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

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Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 2315
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 2318
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 2319
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

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29 Space Radiation 2331
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30 Space Sciences 2341
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 2345
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 2347
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 2351
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

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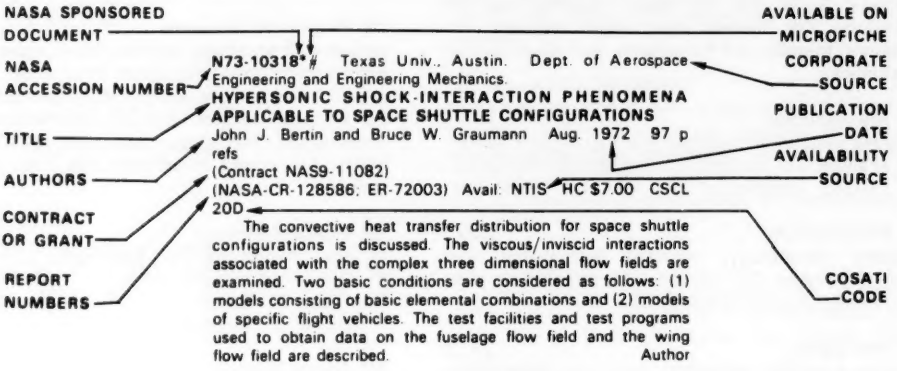
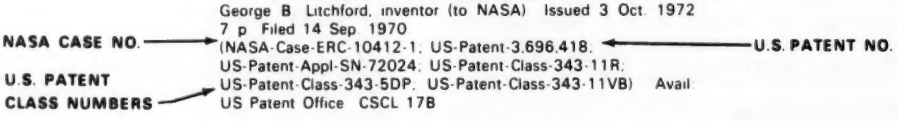


N73-10318*# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.
HYPERSONIC SHOCK-INTERACTION PHENOMENA APPLICABLE TO SPACE SHUTTLE CONFIGURATIONS
John J. Bertin and Bruce W. Graumann Aug. 1972 97 p refs
(Contract NAS9-11082)
(NASA-CR-128586; ER-72003) Avail: NTIS HC $7.00 CSCL 20D

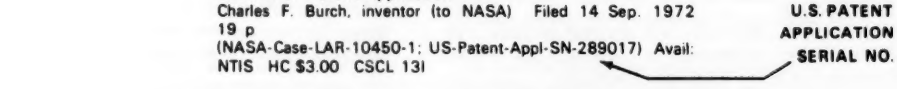
The convective heat transfer distribution for space shuttle configurations is discussed. The viscous/inviscid interactions associated with the complex three dimensional flow fields are examined. Two basic conditions are considered as follows: (1) models consisting of basic elemental combinations and (2) models of specific flight vehicles. The test facilities and test programs used to obtain data on the fuselage flow field and the wing flow field are described. Author

PATENT CITATION



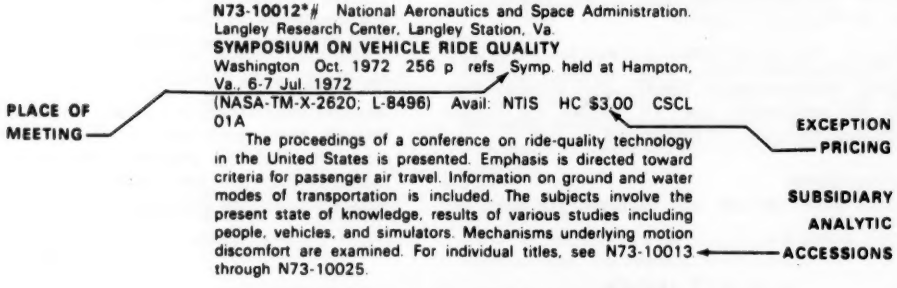
N73-12211* National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ALTITUDE MEASURING SYSTEM Patent
George B. Litchford, inventor (to NASA) Issued 3 Oct. 1972 7 p Filed 14 Sep. 1970
(NASA-Case-ERC-10412-1; US-Patent-3,696,418; US-Patent-Appl-SN-72024; US-Patent-Class-343-11R; US-Patent-Class-343-5DP, US-Patent-Class-343-11VB) Avail: US Patent Office CSCL 17B

PATENT APPLICATION CITATION



N73-10504*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GRINDING ARRARGEMENT FOR BALL NOSE MILLING CUTTERS Patent Application
Charles F. Burch, inventor (to NASA) Filed 14 Sep. 1972 19 p
(NASA-Case-LAR-10450-1; US-Patent-Appl-SN-289017) Avail: NTIS HC $3.00 CSCL 13I

PRIMARY ANALYTIC CITATION AND ABSTRACT



N73-10012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SYMPOSIUM ON VEHICLE RIDE QUALITY
Washington Oct. 1972 256 p refs Symp. held at Hampton, Va., 6-7 Jul. 1972
(NASA-TM-X-2620; L-8496) Avail: NTIS HC $3.00 CSCL 01A

The proceedings of a conference on ride-quality technology in the United States is presented. Emphasis is directed toward criteria for passenger air travel. Information on ground and water modes of transportation is included. The subjects involve the present state of knowledge, results of various studies including people, vehicles, and simulators. Mechanisms underlying motion discomfort are examined. For individual titles, see N73-10013 through N73-10025.

SUBSIDIARY ANALYTIC CITATION

N73-10014* Douglas Aircraft Co., Inc., Long Beach, Calif.
AN AIRCRAFT MANUFACTURER'S APPROACH TO RIDEABILITY CRITERIA
R. C. OMassey, H. Lave, and J. G. Gaume *In* NASA. Langley Res. Center Symp. on Vehicle Ride Quality Oct. 1972 p 23-49 refs (For availability see N73-10012 01-02)
CSCL 01A

VOLUME 11 NUMBER 19 / OCTOBER 8, 1973

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N73-27885 Notre Dame Univ., Ind.
AN INVESTIGATION TO CONTROL THE MAGNUS CHARACTERISTICS OF SYMMETRICAL FIN AND NON-FIN BODIES Ph.D. Thesis
David Walter Lando 1972 155 p
Avail: Univ. Microfilms Order No. 73-8073

An experimental investigation of the effects of N-vanes on the dynamic stability of spinning bodies is presented. The nose mounted N-vanes for each test configuration were of circular cross-section located at four stations at constant angular orientations with respect to the longitudinal body axis. Three-degrees-of-freedom dynamic wind tunnel tests, strain gauge tests, and flow visualization studies were employed to determine the effects of the N-vanes on the magnus characteristics of two configurations. The models were tested over a nondimensionalized spin to velocity ratio range from zero to a maximum of 1.6, an angle of attack range from zero degrees to 20 deg, and at a Reynolds number based on length of 6.08 x 100,000. The three-degrees-of-freedom wind tunnel tests demonstrated that the magnus instabilities of the models could be controlled and altered by the proper orientation of the N-vanes. Dissert. Abstr.

N73-27886*# Scientific Translation Service, Ann Arbor, Mich.
THE INFLUENCE OF AN INCLINED JET ON THE FLOW FIELD IN THE VICINITY OF A LIFTING SURFACE AND ON ITS AERODYNAMIC COEFFICIENTS. PART 2: LITERATURE SURVEY
M. Seidel Washington NASA Jul. 1973 58 p refs Transl. into ENGLISH of "Der Einfluss eines geneigten Strahles auf das Atroemungsfeld in der Umgebung eines Leitwerks sowie auf dessen Luftkraftbeiwerte. Teil 2: Literaturuebersicht", DFLR, Inst. for Aerodyn., West Germany, report DFLR-69/3, Jan. 1969 62 p
(Contract NASw-2483)
(NASA-TT-F-14957; DFLR-69-3) Avail: NTIS HC $5.00 CSCL 01A

An extensive literature survey on jet propagation and jet interference up to the year 1967 is presented. The report contains numerous figures from the most important references. Author

N73-27887*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FULL-SCALE EXPERIMENTS WITH AN EJECTOR TO REDUCE JET ENGINE EXHAUST NOISE
Bruce J. Clark Washington Aug. 1973 31 p refs
(NASA-TM-X-2841; E-7445) Avail: NTIS HC $3.75 CSCL 20A

Experiments with a modified J65 turbojet engine and ejector resulted in noise power reductions as large as 13 decibels in the low-frequency range. High-frequency noise power, which appeared to originate mainly from the mixing processes within the ejector, increased. Peak velocities at the ejector exit were reduced by one-half to two-thirds, although survey rakes showed that mixing was not complete. Acoustical lining inside the ejector would reduce the perceived noise level (in PNdB) by removing much of the high-frequency noise. Author

N73-27888*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF NOSE SHAPE AND TAIL LENGTH ON SUPERSONIC STABILITY CHARACTERISTICS OF A PROJECTILE
Wallace C. Sawyer and Ida K. Collins Washington Aug. 1973 17 p ref
(NASA-TM-X-2831; L-8995) Avail: NTIS HC $3.00 CSCL 01A

The effect of nose shape and tail length on the static stability of a fin-stabilized projectile has been investigated in the Langley Unitary Plan with tunnel at angles of attack to about 12 deg for a Mach number range from 1.5 to 2.5. The tests were made at a constant Reynolds number of 6.56 x 1,000,000 per meter. The results of the investigation showed that nose shape had no effect on the static stability. Increasing the tail length resulted in a progressively stabilizing tendency. However, only the 1.5-caliber-tail-length configuration was stable over the test angle-of-attack range at Mach number 1.5. This configuration was marginally stable or unstable at the higher Mach numbers, and the shorter configurations were unstable at all Mach numbers for either part of or the entire test angle-of-attack range.
Author

N73-27889*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE NUMERICAL SIMULATION OF THREE-DIMENSIONAL TRANSONIC FLOW WITH APPLICATION TO THE C-141 WING
Harvard Lomax, Frank R. Bailey, and William F. Ballhaus Washington Aug. 1973 51 p refs
(NASA-TN-D-6933; A-4583) Avail: NTIS HC $3.00 CSCL 01C

Results computed by a finite-difference, relaxation algorithm are presented for the supercritical flow (M = 0.825) about the C-141 airplane wing, which has sweep, taper, and twist. Comparisons with both wind-tunnel and flight data indicate that computed solutions of the classical transonic small disturbance equation can accurately simulate high Reynolds number flows when the shock sweep angle is small. It is also shown that this equation poorly approximates the complete potential equation when embedded shock waves are swept at angles greater than about 15 deg. Hence, a more consistent small disturbance equation is derived for use in more general cases. Author

N73-27890*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
ANALYTICAL METHOD FOR PREDICTING THE PRESSURE DISTRIBUTION ABOUT A NACELLE AT TRANSONIC SPEEDS. Final Report

J. S. Keith, D. R. Ferguson, C. L. Merkle, P. H. Heck, and D. J. Lahti Washington NASA Jul. 1973 156 p refs
(Contract NAS1-10804)
(NASA-CR-2217) Avail: NTIS HC $3.00 CSCL 01A

The formulation and development of a computer analysis for the calculation of streamlines and pressure distributions around two-dimensional (planar and axisymmetric) isolated nacelles at transonic speeds are described. The computerized flow field analysis is designed to predict the transonic flow around long and short high-bypass-ratio fan duct nacelles with inlet flows and with exhaust flows having appropriate aerothermodynamic properties. The flow field boundaries are located as far upstream and downstream as necessary to obtain minimum disturbances at the boundary. The far-field lateral flow field boundary is analytically defined to exactly represent free-flight conditions or solid wind tunnel wall effects. The inviscid solution technique is based on a Streamtube Curvature Analysis. The computer program utilizes an automatic grid refinement procedure and solves the flow field equations with a matrix relaxation technique. The boundary layer displacement effects and the onset of turbulent separation are included, based on the compressible turbulent boundary layer solution method of Stratford and Beavers and on the turbulent separation prediction method of Stratford.
Author

N73-27891*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS AT MACH 0.60 TO 4.63 OF TWO CRUCIFORM MISSILE MODELS, ONE HAVING TRAPEZOIDAL WINGS WITH CANARD CONTROLS AND THE OTHER HAVING DELTA WINGS WITH TAIL CONTROLS
William A. Corlett and Dorothy T. Howell Washington Jul. 1973 134 p refs
(NASA-TM-X-2780; L-8818) Avail: NTIS HC $3.00 CSCL 14D

Investigations have been conducted in an 8-foot transonic pressure tunnel, the 4-foot supersonic pressure tunnel, and the Unitary Plan wind tunnel at Mach numbers from 0.60 to 4.63 to determine the aerodynamic characteristics of two missile configurations which utilized a common body. One configuration had trapezoidal wings and canard controls; the other configuration had delta wings and aft tail controls. In addition, two forebody shapes were tested, one conical and the other a blunted ogive. The results indicate that both configurations have a high degree of maneuvering capability, with the tail controls providing higher trimmed lift values up to a Mach number of 2.86 and the canard controls providing higher values above a Mach number of 2.86. The canard controls providing higher values above a Mach number of 2.86. The canard configuration has the larger aerodynamic-center variation between subsonic and supersonic Mach numbers, and the conical forebody generally has slightly higher drag than the blunted ogive.
Author

N73-27892# Naval Postgraduate School, Monterey, Calif.
TRANSONIC AERODYNAMICS PAST PROGRESS AND CURRENT STATUS
Max F. Platzer Dec. 1972 34 p refs
(AD-761551; NPS-57PL721201A) Avail: NTIS CSCL 20/4

A summary of the past progress, current status, and development trends of transonic aerodynamics is presented. The main methods of computing steady and unsteady transonic flows are reviewed. Recent advances in buffet prediction and transonic airfoil design are summarized and attention is drawn to the problems requiring additional research efforts.
Author

N73-27893# Advanced Technology Center, Inc., Dallas, Tex.
WIND TUNNEL TESTS OF A TRAPPED VORTEX-HIGH LIFT AIRFOIL Final Report, 23 Feb. - 23 Dec. 1972
K. M. Krall and C. H. Haight 23 Dec. 1972 61 p refs
(Contract N00019-72-C-0379)
(AD-762077; ATC-B-94300/3TR-10) Avail: NTIS CSCL 01/3

Two-dimensional low speed wind-tunnel tests have demonstrated the feasibility of employing trapped vortex diffusion on a high lift airfoil configuration. All 11 percent supercritical airfoil was selected as the base contour employing both leading and trailing edge flaps. The leading edge flap was 25 percent chord, drooped 30 degrees with the rear flap, 27 percent chord, deflected 15 degrees and 30 degrees. Trapped vortex cavities, affording boundary layer control with rapid diffusion, are located at each of the flap knees. Because of the high trapped vortex efficiency, blowing requirements are minimal. Section lift coefficients, in excess of 6, were achieved in the test. (Modified Author Abstract)
GRA

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N73-27894 California Univ., Los Angeles.
DYNAMIC SOARING Ph.D. Thesis
Ferdinand Hendricks 1972 147 p
Avail: Univ. Microfilms Order No. 73-10432

The behavior of a glider, or gliding bird, in a non-uniform wind is considered with emphasis on the question how to stay aloft. The glider is thought to be a mass point with realistic aerodynamic properties. Two idealized wind fields are considered: one with a uniform vertical shear, the other isotropically turbulent without mean non-uniformities. For two-dimensional glides in mean shear phaseplane descriptions of the motion are given. By appropriate assembling of up- and downwind phaseplanes energy can be derived from the flow. Three-dimensional, weakly controlled motion is treated in three distinct perturbation procedures where the drag coefficient tends to zero. The main results are that the phugoid frequency must be the same as that of the horizontal turning motion and that beneficial shear effects are magnified as the wing loading increases. A numerical example shows that dynamic soaring for realistic shear and glider parameters is, mechanically speaking, possible.
Dissert. Abstr.

N73-27895# Advisory Group for Aerospace Research and Development, Paris (France).
INFLUENCE OF PILOT AND AIRCRAFT CHARACTERISTICS ON STRUCTURAL LOADS IN OPERATIONAL FLIGHT
J. R. Sturgeon May 1973 29 p refs
(AGARD-R-608) Avail: NTIS HC $3.50

Some aircraft handling problems met in operational conductions are described and compared with flight test conditions. It is concluded that errors in flight instrumentation and physiological cues have a substantial influence on control capability. A unified strategy for flight in all operational conditions is required to reduce these problems. A strategy, aimed at minimising structural loads and aerodynamic problems in all flight conditions, is proposed that will restore to pilot and autopilot flying the positive stability in pitch and yaw which is a classic requirement for aircraft operating in the stick free mode. Proposals are made for improving the requirements of flight instruments to reduce control problems during complex maneuvres and flight in severe wind shear conditions.
Author

N73-27896# Civil Aeromedical Inst., Oklahoma City, Okla.
APPLICATION OF COMMERCIAL AIRCRAFT ACCIDENT INVESTIGATION TECHNIQUES TO A RAILROAD DERAILMENT
Gale Braden, William Reed, and John J. Swearingen Jan. 1973 37 p refs
(FAA-AM-73-1) Avail: NTIS HC $4.00

Crash investigation techniques utilized by human factors teams in investigating commercial airline crashes were applied in the analysis of a railroad train derailment-crash. Passengers in cars that remained upright experienced very low deceleration forces and practically no injuries in stopping from a speed of 90 miles per hour over distances in excess of 1,000 feet. Four passenger cars and the diner were turned over on their sides and continued to slide after jackknifing. During the turn-over and slide these cars were penetrated by railroad rails, cross ties, and a heavy compressor. Several passengers were ejected through windows

and crushed beneath the cars. The 11 deaths and all severe and serious injuries occurred in these five overturned cars. An analysis of escape routes from an overturned railroad passenger car is presented and shows that it is difficult for an injured passenger to escape. Author

N73-27897*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NOISE TESTS OF A MODEL ENGINE-OVER-THE-WING STOL CONFIGURATION USING A MULTIJET NOZZLE WITH DEFLECTOR
William A. Olsen and Robert Friedman Washington Aug. 1973 26 p refs
(NASA-TM-X-2871; E-7459) Avail: NTIS HC $3.00 CSCL 01C

Noise data were obtained with a small scale model stationary STOL configuration that used an eight lobe mixer nozzle with deflector mounted above a 32-cm-chord wing section. The factors varied to determine their effect upon the noise were wing flap angle, nozzle shape, nozzle location, deflector configuration, and jet velocity. The noise from the mixer nozzle model was compared to the noise from a model using a circular nozzle of the same area. The mixer nozzle model was quieter at the low to middle frequencies, while the circular nozzle was quieter at high frequencies. The perceived noise level (PNL) was calculated for an aircraft 10 times larger than the model. The PNL at 500 feet for the mixer nozzle turned out to be within 1 db of the PNL for the circular nozzle. For some configurations at highly directional broadband noise, which could be eliminated by changes in nozzle and/or deflector location, occurred below the wing. Author

N73-27898*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LEADING EDGE SERRATIONS WHICH REDUCE THE NOISE OF LOW-SPEED ROTORS
Paul T. Soderman Aug. 1973 65 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TN-D-7371; A-4074) Avail: NTIS HC $3.00 CSCL 01C

Acoustic effects of serrated brass strips attached near the leading edges of two different size rotors were investigated. The two bladed rotors were tested in hover. Rotor rotational speed, blade angle, serration shape, and serration position were varied. The serrations were more effective as noise suppressors at rotor tip speeds less than 135 m/sec (444 ft/sec) than at higher speeds. high frequency noise was reduced but the low frequency rotational noise was little affected. Noise reductions from 4 to 8 db overall sound pressure level and 3 to 17 db in the upper octave bands were achieved on the 1.52 m (5.0 ft) diameter rotor. Noise reductions up to 4 db overall sound pressure level were measured for the 2.59 m (8.5 ft) diameter rotor at some conditions. Author

N73-27899*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 2: AIRCRAFT Final Report
Jun. 1973 448 p refs
(Contract NAS2-6994)
(NASA-CR-114607; MDC-J4371-Vol-2) Avail: NTIS HC $24.50 CSCL 01C

A study of the quiet turbofan STOL aircraft for short haul transportation was conducted. The objectives of the study were as follows: (1) to determine the relationships between STOL characteristics and economic and social viability of short haul air transportation, (2) to identify critical technology problems involving introduction of STOL short haul systems, (3) to define representative aircraft configurations, characteristics, and costs, and (4) to identify high payoff technology areas to improve STOL systems. The analyses of the aircraft designs which were generated to fulfill the objectives are summarized. The baseline aircraft characteristics are documented and significant trade studies are presented. Author

N73-27900*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 3: AIRPORTS Final Report
Jun. 1973 523 p refs
(Contract NAS2-6994)
(NASA-CR-114608; MDC-J4371-Vol-3) Avail: NTIS HC $28.25 CSCL 01C

The airport siting, design, cost, operation, and implementation aspects of a short takeoff aircraft transportation system are analyzed. Problem areas are identified and alternative solutions or actions required to achieve system implementation by the early 1980's are recommended. Factors associated with the ultimate community acceptance of the STOL program, such as noise, emissions, and congestion, are given special emphasis. Author

N73-27901*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 4: MARKETS Final Report
Jun. 1973 279 p refs
(Contract NAS2-6994)
(NASA-CR-114609; MDC-J4371-Vol-4) Avail: NTIS HC $16.00 CSCL 01C

A marketing study to determine the acceptance and utilization of a STOL aircraft short-haul air transportation system was conducted. The relationship between STOL characteristics and the economic and social viability of STOL as a short-haul reliever system was examined. A study flow chart was prepared to show the city pair and traffic split analysis. The national demand for STOL aircraft, as well as the foreign and military markets, were analyzed. Author

N73-27902*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 5: ECONOMICS Final Report
Jun. 1973 333 p refs
(Contract NAS2-6994)
(NASA-CR-114610; MDC-J4371-Vol-5) Avail: NTIS HC $18.75 CSCL 01C

The economic aspects of the STOL aircraft for short-haul air transportation are discussed. The study emphasized the potential market, the preferred operational concepts, the design characteristics, and the economic viability. Three central issues governing economic viability are as follows: (1) operator economics given the market, (2) the required transportation facilities, and (3) the external economic effects of a set of regional STOL transportation systems. Author

N73-27903*# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDY OF QUIET TURBOFAN STOL AIRCRAFT FOR SHORT-HAUL TRANSPORTATION. VOLUME 6: SYSTEMS ANALYSIS Final Report
Jun. 1973 534 p refs
(Contract NAS2-6994)
(NASA-CR-114611; MDC-J4371-Vol-6) Avail: NTIS HC $28.75 CSCL 01C

A systems analysis of the quiet turbofan aircraft for short-haul transportation was conducted. The purpose of the study was to integrate the representative data generated by aircraft, market, and economic analyses. Activities of the study were to develop the approach and to refine the methodologies for analytic tradeoff, and sensitivity studies of propulsive lift conceptual aircraft and their performance in simulated regional airlines. The operations of appropriate airlines in each of six geographic regions of the United States were simulated. The offshore domestic regions were evaluated to provide a complete domestic evaluation of the STOL concept applicability. Author

N73-27904*# McDonnell-Douglas Corp., Long Beach, Calif.
THE RESULTS OF A LOW SPEED WIND TUNNEL TEST TO INVESTIGATE THE EFFECTS OF INSTALLING REFAN JT8D ENGINES ON THE MCDONNELL DOUGLAS DC-9-30
H. E. Chrisenberry, P. G. Doss, A. E. Kressly, R. D. Prichard, and C. S. Thorndike Jun. 1973 41 p ref
(Contract NAS3-16814)
(NASA-CR-121220; MDC-J5961) Avail: NTIS HC $4.25 CSCL 01C

A low speed wind tunnel test was conducted to assess the

effects of the larger JT8D refan nacelles on the stability and control characteristics of the DC-9-30, with emphasis on the deep stall regime. Deep stall pitching moment and elevator hinge moment data, and low angle of attack tail-on and tail-off pitching moment data are presented. The refan nacelle was tested in conjunction with various pylons of reduced span relative to the production DC-9-30 pylon. Also, a horizontal tail that was larger than the production tail was tested. The data show that the refan installation has a small detrimental effect on the DC-9-30 deep stall recovery capability, that recovery characteristics are essentially independent of pylon span, and that the larger horizontal tail significantly increases recovery margins. The deep stall characteristics with the refan installation, within the range of pylon spans tested, are acceptable with no additional design changes anticipated. Author

N73-27905*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EFFECTS OF FLAPS ON BUFFET CHARACTERISTICS AND WIND-ROCK ONSET OF AN F-8C AIRPLANE AT SUBSONIC AND TRANSONIC SPEEDS
Richard C. Monaghan and Edward L. Friend Washington Aug. 1973 27 p refs
(NASA-TM-X-2873; H-742) Avail: NTIS HC $3.00 CSCL 01B

Wind-up-turn maneuvers were performed to establish the values of airplane normal force coefficient for buffet onset, wing-rock onset, and buffet loads with various combinations of leading- and trailing-edge flap deflections. Data were gathered at both subsonic and transonic speeds covering a range from Mach 0.64 to Mach 0.92. Buffet onset and buffet loads were obtained from wingtip acceleration and wing-root bending-moment data, and wing-rock onset was obtained from airplane roll rate data. Buffet onset, wing-rock onset, and buffet loads were similarly affected by the various combinations of leading- and training-edge flaps. Subsonically, the 12 deg leading-edge-flap and trailing-edge-flap combination was most effective in delaying buffet onset, wing-rock onset, and equivalent values of buffet loads to a higher value of airplane normal force coefficient. This was the maximum flap deflection investigated. Transonically, however, the optimum leading-edge flap position was generally less than 12 deg. Author

N73-27906# Advisory Group for Aerospace Research and Development, Paris (France).
V/STOL HANDLING-QUALITIES CRITERIA. PART 2: DOCUMENTATION
Jun. 1973 88 p refs
(AGARD-R-577-Pt-2) Avail: NTIS HC $6.50

The factors which affect the handling characteristics of V/STOL aircraft are discussed. The criteria are based on several sources of information to include: (1) analytical studies, (2) piloted simulator tests, (3) flight tests, and (4) specially equipped variable stability aircraft and helicopters. The results of the tests involving handling and stability are presented in tabular form. Author

N73-27907*# Boeing Commercial Airplane Co., Seattle, Wash.
DESIGN INTEGRATION AND NOISE STUDIES FOR JET STOL AIRCRAFT. TASK 7A: AUGMENTOR WING CRUISE BLOWING VALVELESS SYSTEM. VOLUME 2: DESIGN EXPLORATION
Oct. 1972 131 p ref
(Contract NAS2-6344)
(NASA-CR-114570; D6-40829-Vol-2) Avail: NTIS HC $8.75 CSCL 01C

A design integration study program was conducted to determine size and performance parameters of an augmentor wing cruise blowing (valveless) system in a 150-passenger STOL airplane for the purpose of defining size and configuration of static rig, flow duct, and wind tunnel test hardware. The studies encompassed blowing systems powered by low-pressure (single stage) and high-pressure (three and four stage) engine fans. A range of wing aspect ratios, wing thicknesses, and duct flow velocity effects were investigated to establish airplane characteristics which minimize takeoff gross weight while achieving sideline noise requirements for an advanced commercial STOL airplane. Author

N73-27908*# Translation Consultants, Ltd., Arlington, Va.
EXTERNAL LOADS AND AIRCRAFT STRENGTH
A. I. Gudkov and P. S. Leshakov Washington NASA Jul. 1973 392 p refs Transl. into ENGLISH of the book "Vneshniye Nagruzki i Prochnost Letatelnykh Apparatov" Moscow, Mashinostroyeniye Press, 1968 p 1-204, 270-444
(Contract NASw-2038)
(NASA-TT-F-753) Avail: NTIS HC $6.00 CSCL 01C

The fundamentals of oscillation theory and mathematical statistics applicable to problems of the dynamics of aircraft structures and aerodynamic loads on aircraft and missiles during various stages of flight are presented. Data is included on the elasticity of structures in gusts of rough air when taking off and landing, vibrations of aircraft and helicopter parts, and the effect of these parameters on the strength of the structure and the performance of aircraft equipment. An analysis of the structural parameters influencing flutter and the methods used to study flutter characteristics is provided. The fatigue strength of aircraft structures and the basic trends in the use of computers to study the dynamic strength of aircraft structures are reported. Author

N73-27909*# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.
A PRACTICAL SCHEME FOR ADAPTIVE AIRCRAFT FLIGHT CONTROL SYSTEMS
Michael Athans and Dieter Willner Apr. 1973 24 p refs Prented at the Symp. on Parameter Estimation Tech. and Appl. in Aircraft Flight testing, Edwards AFB, Calif., 24-25 Apr. 1973
(Grants AF-AFOSR-2273-72; NGL-22-009-124)
(NASA-CR-133416; AD-760790; AFOSR-73-0909TR) Avail: NTIS HC $3.25 CSCL 01/3

The purpose of the report is to present a flight control system design, that can be implemented by analog hardware, to be used to control an aircraft with uncertain parameters. The design is based upon the use of modern control theory. The ideas are illustrated by considering control of STOL longitudinal dynamics. Author (GRA)

N73-27910# Institut Franco-Allemand de Recherches, St. Louis (France).
DESTRUCTIVE BOOM EFFECTS ON LIGHT PARTITIONS. PRELIMINARY STUDY [EFFETS DESTRUCTIFS DU BANG SUR DES CLOISONS LEGERES. ETUDE PRELIMINAIRE SAP HC $4.50]
D. Hellstern 4 Sep. 1972 49 p refs In FRENCH
(Contract DRME-72/184)
(ISL-23/72) Avail: NTIS

In order to predict the reaction to shock of light partitions subjected to sonic boom generated by the ISL shock tube, the sonic boom effect on partitions and ceiling of a room was investigated using shock waves penetrating into the enclosure (room) through the apertures (windows, doors). The theoretical response of an enclosure to pressure waves was studied. Experimental work carried out on scale models agree with the theory. It is however impossible to estimate the influence and importance of the incident wave degradation, and therefore the acoustic response of the real enclosure (4 x 3 x 2.5 cu cm). ESRO

N73-27911# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
FURTHER DEVELOPMENT OF NOISE DATA WITH REGARD TO THE RESULTS OF AIRCRAFT NOISE INVESTIGATIONS OF THE DFG AT MUNICH [ZUR WEITERENTWICKLUNG VON LAERMINDIZES UNTER BERUECKSICHTIGUNG DER ERGEBNISSE DER FLUGLAERMUNTERSUCHUNG DER DEUTSCHEN FORSCHUNGSGEMEINSCHAFT IN MUENCHEN]
K. Matschat, E. A. Mueller, and G. Zimmermann Mar. 1973 37 p refs In GERMAN
(Rept-3/1973) Avail: NTIS HC $4.00; Max-Planck-Inst. fuer Stroemungsforsch. 10,90 DM

A general statement is given for a noise index L, as a further development of the noise indexes presently used, which for the most part are based on the concept of intensity averaging. The statement was developed from spectral analysis of the level characteristic L(t) during a reference time range T, and frequency evaluation thereof. By special choice of the evaluation curve

one perceives that fast level variations produce a higher noise index than slow variations (for equal intensity mean value). The statement for L contains a constant t, the inverse of which indicates the limit, from the time the amount of level variation velocity dL/dt appreciably adds to the noise index. It is shown that the noise index L satisfies certain normalization and tolerance conditions generally necessary for a noise index. L was tested with data of aircraft noise measurements. An approximation of l/t was found to be 2 db/sec. ESRO

N73-27912# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE TECHNOLOGY OF CEMENTING PARTS IN AIRCRAFT CONSTRUCTION

I. I. Kapelyushnik and I. I. Mikhalev 23 Apr. 1973 317 p refs Transl. into ENGLISH from the monograph "Tekhnologiya Sklelvaniya Datalei v Samoletostroenii" Moscow, 1972 p 1-224

(AD-761496; FTD-MT-24-14-73) Avail: NTIS CSCL 01/3

The book describes the technology of joining metals and nonmetallic structural materials with the aid of gluing, providing high strength, service life, airtightness and good corrosion resistance of surfaces being glued. The physicomechanical and technical characteristics of glue, and also the types of glue joints used in airplane constructions are given. Primary attention is given to the selection of rational production processes of gluing, industrial equipment, preparation and testing of glue, quality control of gluing and safety techniques in working with glues. GRA

N73-27913# Raven Industries, Inc., Sioux Falls, S.Dak. Flight Operations Dept.

SKYHOOK CHURCHILL 1972 Interim Report

Paul S. White and Thomas Pappas 2 Apr. 1973 176 p (Contract N00014-72-C-0400; NR Proj. 211-161)

(AD-761657; R-0473002) Avail: NTIS CSCL 04/1

The program was funded to conduct balloon field operations from Fort Churchill, Manitoba, Cape Girardeau, Missouri, and Red Deer, Alberta. The report describes individual flights, equipment used, flight data, and various program information. (Modified Author Abstract) GRA

N73-27914# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.

PRELIMINARY STUDY OF OPTIMAL WAVE-OFF CONTROL: A PARAMETRIC APPROACH Phase Report

Mark E. Reigle and Ralph H. Smith 23 Apr. 1973 37 p refs

(AD-761617; NADC-72079-VT) Avail: NTIS CSCL 01/2

The feasibility of optimizing the wave-off perfotmance of Naval aircraft is briefly considered. A simple, parametric approach to the problem is employed as a means of evaluating the potential of optimal control while avoiding the mathematical difficulties. It is concluded that the performance benefits from the use of optimal control are considerable in principle but may be difficult to realize in practice. Author (GRA)

N73-27915# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Airframe Div.

DEVELOPMENT OF A ROLLING MANEUVER SPECTRUM FROM STATISTICAL FLIGHT LOADS DATA

John W. Rustenburg Apr. 1973 52 p refs

(AD-761491; ASD-TR-72-113) Avail: NTIS CSCL 01/3

Absence of clearly defined antisymmetrical fatigue load spectra in military specifications has resulted in questions regarding the validity of rolling maneuver spectra applied to the B-1 design. In response, multiparameter flight loads data measured on the F-5A and F/105D aircraft were evaluated and used in the development of a probability of exceedance curve for the normalized wing tip helix angle. The normalized probability curve can be used in conjunction with any specified normal load factor spectrqm and the airplanes maximum pb/2V capabilities to determine the occurrence rate of rolling velocity peaks. The approach should provide at least a first order estimate of possible rolling velocity spectra which can be applied in aircraft fatigue design for antisymmetrical maneuver conditions. Author (GRA)

N73-27916# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A STATE VARIABLE DESIGN APPROACH FOR A HIGH PERFORMANCE AEROSPACE VEHICLE PITCH ORIENTATION SYSTEM WITH VARIABLE COEFFICIENTS M.S. Thesis

Richard A. Ray Mar. 1973 137 p refs

(AD-761493; GGC/EE/73-15) Avail: NTIS CSCL 01/3

The purpose of the thesis was to design a simple state-variable feedback system to control a linear plant with variable coefficients. The solution of the problem was to determine the values of the constant feedback gains based on a desired transfer function. This transfer function met all required time responses. One of the state-variables is an internal state and not available for measurement. This state is reconstructed using a minor-loop feedback circuit. A nominal set of conditions was selected for the plant and the feedback coefficients determined as a function of the nominal plant parameters and coefficients of the desired transfer function. Using the values of feedback coefficients determined above, the response of the control system was simulated at several flight conditions. (Modified Author Abstract) GRA

N73-27917# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.

LOW SPEED AERODYNAMIC CHARACTERISTICS OF AN A-4 AIRCRAFT WITH AN AIR CUSHION LANDING SYSTEM

David G. Lee and H. Dulany Davidson, Jr. Feb. 1973 52 p refs

(ARPA Order 2121)

(AD-761621; Evaluation-AL-98) Avail: NTIS CSCL 01/3

The effect of a twin trunk air cushion landing gear system on the stability and control of an A-4 type aircraft was evaluated through an exploratory wind tunnel program. The active air cushion in ground effect conditions was found to reduce both drag and the static margin and markedly degrade the directional stability characteristics of the 22 percent scale wind tunnel model. However, the modified aircraft retains adequate longitudinal stability and both the flaps and stabilizer controls are effective and adequate for trimming the aircraft. Author (GRA)

N73-27918# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRUCTURAL AND FORCE DIAGRAMS OF THE LANDING GEAR

V. L. Belskii and I. P. Vlasov 16 May 1973 42 p Transl. into ENGLISH from the monograph "Konstruktsiya Latatelnykh-Apparatov" Moscow, 1963 p 507-532

(AD-761644; FTD-MT-24-1826-72) Avail: NTIS CSCL 01/3

Contents: Structural and force diagrams of landing gear--External landing-gear loads; The structural and force diagrams of landing gear; Landing-gear computation for strength; Diagram of landing-gear retracting mechanism. GRA

N73-27919# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF FLYING TIME ON RESIDUAL LIFE OF MAIN MEMBERS OF AN AIRFRAME

K. D. Mirtov, G. I. Nesterenko, V. G. Petukhov, and M. L. Skripka 17 May 1973 26 p Transl. into ENGLISH from Vopr. Ekspluatatsionnoi Prochnosti Nadezhnosti Aviats. Konstrukt. (Riga), v. 6, no. 191, 1971 p 14-38

(AD-761468; FTD-HT-23-254-73) Avail: NTIS CSCL 01/3

Results are given for two series of tests of wind fastening knee plates on one of the transport aircraft having varying accrued operating time under operational conditions. Data obtained can be used to estimate wing fatigue life. GRA

N73-27920# Army Cold Regions Research and Engineering Lab., Hanover, N.H.

OBSERVATIONS OF SURFACE EFFECT VEHICLE PERFORMANCE

R. A. Liston Apr. 1973 65 p

(ARPA Order 1615)

(AD-762169; CRREL-TR-240) Avail: NTIS CSCL 01/3

A series of tests conducted in the vicinity of Houghton, Michigan, utilizing the SK-5 surface effect vehicle are discussed. The tests represent a continuation of an earlier study to investigate

the interaction between surface effect vehicle and arctic terrain. The following tests were conducted and are reported on: evaluation of air cushion vehicle operations on railroad beds and on secondary roads; the identification of maneuver requirements as a function of vehicle characteristics; evaluation of air cushion vehicle operations on inland waterways; measurement of water speed, craft weight, and skirt drag; and analysis of dynamic response to geometric obstacles. Author (GRA)

N73-27921# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF TECHNICAL DIAGNOSTICS FOR THE DETERMINATION OF THE REPLACEMENT DATES OF AIRCRAFT ACCESSORIES

N.N. Smirnov, A.A. Itskovich, and V.I. Zagrebeinyi Transl. into ENGLISH from Tr. Vses. Soveshshanie Tekhn. Diagnostike (USSR), 1972 p 69-73

(AD-762226; FTD-HT-23-515-73) Avail: NTIS CSCL 01/3

The report develops a mathematical model for determining replacement criteria for aircraft structural components. GRA

N73-27922# McDonnell Aircraft Co., St. Louis, Mo.

COMPATIBILITY OF MANEUVER LOAD CONTROL AND RELAXED STATIC STABILITY APPLIED TO MILITARY AIRCRAFT Final Report, Jan. 1971 - Feb. 1973

Roger L. Berger, James P. Hess, and Daniel C. Anderson Apr. 1973 193p refs

(Contract F33615-71-C-1234; AF Proj. 8226)

(AD-762299; AFFDL-TR-73-33) Avail: NTIS CSCL 01/3

The purpose of the research program was to determine the performance benefits which can be obtained for a fighter aircraft through the application of maneuver load control (MLC) and relaxed static stability (RSS), and to evaluate the resulting impact on aircraft handling qualities. Analytical results were to be obtained in this study to indicate whether significant fighter aircraft performance benefits can be realized through the use of MLC and RSS, and whether these aircraft design concepts are compatible for all configurations selected for study. These study results were to show whether desirable handling qualities and adequate stability margins are attainable using existing fly-by-wire flight control system hardware with relatively minor modifications. (Modified Author Abstract) GRA

N73-27923# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SUPERSONIC JET NOISE INVESTIGATION USING JET FLUCTUATING PRESSURE PROBES

Terry D. Scharton, Pritchard H. White, and Peter E. Rentz Jun. 1973 131 p refs

(Contract F33615-71-C-1661)

(AD-762296; BBN-2220; AFAPL-TR-73-35) Avail: NTIS CSCL 20/1

Various mechanisms of jet noise generation are modeled using the fluctuating jet pressures to characterize the sources. The subsonic mixing mechanism is shown to dominate for sonic and mildly supersonic jets. An input-output relation between the jet pressure and sound pressure spectral densities is derived and verified. Fluctuating pressure probes are developed to measure sources of noise generation in sonic and supersonic jet exhausts. Jet exhausts with total temperatures as high as 3500F may be measured. Definitive data are obtained regarding the percentage of the sound radiated at a given angle and frequency by each region of the jet exhaust. Simple laser refraction experiments support the fluctuating pressure measurements. (Modified Author Abstract) GRA

N73-27924# ARO, Inc., Arnold Air Force Station, Tenn.

TRANSONIC SCALING EFFECT ON A QUASI, TWO-DIMENSIONAL C-141 AIR FOIL MODEL Final Report, Feb. 1970 - Jun. 1972

C. F. Lo and W. E. Carleton AEDC Jun. 1973 71 p refs

(ARO Proj. PW3087; ARO Proj. PW3110)

(AD-762285; ARO-PWT-TR-73-13; AEDC-TR-73-61) Avail: NTIS CSCL 01/3

The transonic scaling effect of shock wave/boundary-layer interaction on a quasi, two-dimensional C-141 airfoil was investigated. Data were obtained from the AEDC Propulsion Wind Tunnel Facility Aerodynamic Wind Tunnel (4T) and Propulsion Wind Tunnel (16T) and from the NASA Marshall Space Flight Center High Reynolds Number Tunnel with 6-in. and 24-in.-chord airfoils for a range 0.70 to 0.85. In addition to the investigation of the effect of Reynolds number on the airfoil pressure distribution, the effect of fixed boundary-layer transition was evaluated using grit-type transition strips on the airfoil surface. The significant parameters affecting the shock wave/boundary-layer interaction are identified. The data indicate that simulation of higher Reynolds number data on the C-141 airfoil model is feasible by use of a fixed-boundary-layer-transition strip. Author (GRA)

N73-27925# Goodyear Aerospace Corp., Akron, Ohio.

COMPARISON OF ANALYTICALLY AND EXPERMENTALLY DETERMINED DYNAMIC BEHAVIOR OF TETHERED BALLOONS

Jerome J. Vorachek and George R. Doyle, Jr. 30 Mar. 1973 70 p refs

(Contract F19628-72-C-0219)

(AD-762210; GER-15932; SR-1; AFCRL-TR-73-0284) Avail: NTIS CSCL 01/3

Mathematical tools were developed previously to analyze the dynamic behavior of tethered balloon systems. The model for the tethered balloon system consists of the streamlined balloon and a tether made up of three discrete links. The tools consist of the linearized characteristic equations which incorporate the physical, aerodynamic and mass characteristics of the system and the dynamic simulation computer program which determines the response of the tethered balloon system to wind disturbances. A tethered balloon system consisting of a 70,000 cubic foot aerodynamically shaped balloon and a 0.52 inch diameter Nolaro tether was flown at Fair Site on White Sands Missile Range to obtain experimental motion data. (Modified Author Abstract) GRA

N73-27926# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.

EXPENDABLE MAIN ROTOR BLADE STUDY Final Report

John A. Longobardi and Everett Fournier Apr. 1973 312 p refs

(Contract DAAJ02-71-C-0046; DA Proj. 1F1-622205-A-119)

(AD-762198; SER-50748; USAAMRDL-TR-72-47) Avail: NTIS CSCL 01/3

The report presents Sikorsky's study of expendable blade designs applicable to the Army's UH-1H helicopter with its teetering rotor system. The program included design, reliability, maintainability and cost analysis studies. Reliability and maintainability parameters were developed which were subsequently inserted into cost model equations to determine life cycle cost comparisons of the new blade designs with the present UH-1H blade. More than fifteen configurations were investigated and reduced to six viable blade designs. They included aluminum, steel, and composite configurations. The study covered two time frames: 1972 and 1980. The results showed that a low-cost aluminum extrusion (Configuration I) with a fiberglass composite skin was the most cost effective for 1972. The 1980 time frame showed that an all-composite blade (Configuration V) was the most cost effective. (Modified Author Abstract) GRA

N73-27927# Boeing Vertol Co., Philadelphia, Pa.

FLIGHT TEST OF ADVANCED-GEOMETRY BORON BLADES Final Technical Report

Donald J. Hoffstedt, Harold E. Bishop, and Herbert H. Steinmann Feb. 1973 214 p refs

(Contract DAAJ02-72-C-0010;

(AD-762199; D210-10486-1; USAAMRDL-TR-72-65) Avail: NTIS CSCL 01/3

The report presents the results of an exploratory flight test program conducted on a CH-47C Army helicopter for the purpose of investigating the structural performance of boron-reinforced epoxy aft rotor blades and the associated effects on the helicopter system. The program demonstrated the flightworthiness of boron-reinforced epoxy main rotor blades in the demanding environment of the aft rotor on a tandem-rotor helicopter. No structural problems were encountered. There were no restrictive 3/rev vibrations despite a first-elastic-mode, flap-bending natural frequency of 3.21 times rotor speed. The torsional stiffness of

the boron blade provided excellent blade-to-blade track conformance throughout the program after minimal initial adjustment.
Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; Nuclear Engineering; and 28 Propulsion Systems.

N73-27928*# Stanford Research Inst., Menlo Park, Calif.
FUEL CELL ION-EXCHANGE MEMBRANE INVESTIGATION Final Technical Report, 1 Mar. - 31 Aug. 1972
M. S. Toy 31 Oct. 1972 22 p refs
(Contract NAS3-15577; SRI Proj. 1771)
(NASA-CR-121007) Avail: NTIS HC $3.25 CSCL 10A

The present deficiencies in the fluorocarbon sulfonic acid membrane used as the solid polymer electrolyte in the H2/O2 fuel cell are studied. Considered are: Adhesives selection, elastomeric formulations, scavenger exploration, and membrane characterization. The significant data are interpreted and recommendations are given for both short and long range further investigations in two of the four major areas: membrane adhesives and membrane stabilization.
Author

N73-27929# AEG-Telefunken, Hamburg (West Germany).
CONTROL LOOP ANALYSIS AND COMPUTER MODELLING FOR A DYNAMIC SOLAR-ARRAY SIMULATOR
A. Schreger Feb. 1973 92 p refs
(Contract ESTEC-1453/71-HP)
(ESRO-CR(P)-261) Avail: NTIS HC $6.75

The stability analysis of a feedback control loop for a dynamic solar array simulator is presented. A simulator is proposed, consisting of several functional units. The stability analyses, which were carried out by frequency response determination and by means of computer calculations, show that the problem of instability at the short circuit mode can be solved. In order to prevent unnecessary obstruction of simulator stability analyses, it is recommended that the variation of the loop gain, and hence of the open-loop voltage and the short circuit current be kept within the necessary limits and adapted to the actual requirements. Relations for the impedance of the simulator have shown that they are easily adaptable to various specifications by modification of functional units.
ESRO

N73-27930# Christian Rovsing Ltd., Copenhagen (Denmark).
MAGNETIC FIELD INTERFERENCE OF TRANSFORMERS FOR DC/DC CONVERTERS: TEST REPORT
Chresten Overbeck Paris ESRO Feb. 1973 42 p refs
(Contract ESTEC-1118/70)
(ESRO-CR-84) Avail: NTIS HC $4.25

The results and conclusions of the study of magnetic field interference of transformers for dc/dc converters for satellite power systems are presented. The scope of the study is to establish a basis for an evaluation of the feasibility of using multiple output dc/dc transformer converters in the GEOS satellite. For this purpose the levels of magnetic strain fields were determined for a number of transformers of different design.
ESRO

N73-27931# IIT Research Inst., Chicago, Ill.
FUEL CELL MATRIX MATERIAL STUDY Final Report, 1 Nov. 1971 - 31 Oct. 1972
William B. Crandall and Yoshiro Harada May 1973 68 p refs
(Contract F33615-72-C-1100; AF Proj. 7021; AF Proj. 7021)
(AD-761512; ARL-73-0088) Avail: NTIS CSCL 10/3

The purpose of the program was to improve the resistance of chrysotile asbestos to potassium hydroxide at temperatures greater than 100 C so that the asbestos would function satisfactorily as a matrix mat for hydrogen-oxygen fuel cells. Basic studies of the KOH-asbestos reaction revealed the reaction to be: $Mg_3Si_2O_5 + KOH = 3\ Mg(OH)_2 +$ solubles silicates, the extent of reaction being a function of time, temperature, and KOH concentration. It was determined that the morphology of the Mg (OH)2-asbestos reaction product could be maintained fibrous so that the desirable flexibility and capillarity for a matrix mat were retained. This was the basis for development of a highly converted material with a composition of approximately 85% Mg(OH)2-15% asbestos, which exhibits good physical properties along with greatly improved chemical resistance to KOH. A second development in the studies was the capability to eliminate the KOH-asbestos reaction by addition of soluble potassium silicate to the system.
(Modified Author Abstract) GRA

N73-27932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF THE OPERATING TEMPERATURE REGIME OF A THERMOELECTRIC GENERATOR ON ORGANIC FUEL
A. T. Relevtsev, B. N. Gorshkov, and R. V. Kovalskii 7 Jun. 1973 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energetika i Transport (Moscow), no. 6, 1972 p 101-106
(AD-762266; FTD-HT-23-341-73) Avail: NTIS CSCL 10/2

Temperature conditions are examined for the operation of thermoelectric generators using the combustion heat of organic fuels with radiational and convective heat supply. Analytical relationships are obtained for determining the optimal values for the temperature level of the heat source and the heat-absorbing surface, which ensure that maximum generator efficiency is obtained.
Author (GRA)

N73-27933# AiResearch Mfg. Co., Phoenix, Ariz.
MERDC (MOBILITY EQUIPMENT RESEARCH AND DEVELOPMENT CENTER) 30 AND 60 KW GENERATOR SET STUDY Final Technical Report, May - Oct. 1972
Gerald J. Amarel and Roger J. DeRudder Oct. 1972 419 p refs
(Contract DAAK02-72-C-0317; DA Proj. 1B6-63702-DG-11)
(AD-762200; GT-8838-R) Avail: NTIS CSCL 10/2

The purpose of the program was to identify the critical characteristics of a gas turbine powered generator set of 30- and 60-kw electrical outputs. The primary conclusions of the program are: The generator set sfc requirement of 1.7 lb/kw-hr for the 30 kw unit and 1.2 lb/kw-hr for the 60 kw unit can be achieved without having a complicated engine cycle. The recommended engines for both the 30- and 60-kw units have a single-stage centrifugal compressor, a single-can burner and a single-stage radial-inflow turbine mounted on two bearings and featuring an overhung design. The gearbox has a planetary gear drive. The single-frequency generator configuration is recommended over the multifrequency generator configuration based primarily on cost, weight and performance considerations.
Author (GRA)

N73-27934# Army Electronics Command, Fort Monmouth, N.J.
CONVERSION (dc TO dc) FOR IMPROVED POWER SOURCES
Apr. 1973 32 p refs
(DA Proj. 1T6-62705-A-053)
(AD-762181; ECOM-4108) Avail: NTIS CSCL 09/5

A system concept for improved power sources for surveillance and communications-electronic equipment is described. The proposed system consists of a high energy electrochemical power source in conjunction with an efficient solid state converter-regulator. Potential advantages over a multiple cell stack to provide a stabilized output voltage are presented. Power processor requirements and design consideration are discussed. Three cases representing different source voltage ranges are considered for a trade-off analysis leading to optimized designs and system configurations.
Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N73-27935*# Scientific. Translation Service, Santa Barbara, Calif.
NOISE AND NOISE SICKNESS
Ye. Ts. AndreyevaGalanina, S. V. Alekeseyev, A. V. Kadyskin, and G. A. Suvopov Washington NASA Jul. 1973 339 p refs Transl. into ENGLISH of the publ. "Shum i Shumovaya Bolezn" Leningrad, Meditsina, 1972 304 p
(Contract NASw-2035)
(NASA-TT-F-748) Avail: NTIS HC $6.00 CSCL 06S

Basic concepts and questions about noise, which contribute to a proper understanding of the characteristic of industrial noise as well as an experimental acoustical complex for the study of the noise factor, are examined. Special attention has been given to the effect of noise on the organ of hearing. Important data pertain to physiological research, including the questions of adaptation and fatigue. Changes in occupational hearing losses, caused by the prolonged effect of noise, are discussed. Data are given on the effect of an acoustic stimulus on the eye, motor analyze, on vibration sensitivity and the functional state of the vestibular analyze, involuntary functions, and the cardiovascular system. Data about the effect of noise on the functional state of the central nervous system are presented. It is concluded that both reactivity and lability of the cortex and subcortical structures are reduced, evidently in proportion to the noise effect. The degree of these effects is determined by the force of the noise. Author

N73-27936*# Massachusetts Inst. of Tech., Cambridge.
ROBOT VISION Final Report
Louis L. Sutro and Jerome B. Lerman Apr. 1973 78 p refs
(Contract NSR-22-009-138)
(NASA-CR-133458; R-635) Avail: NTIS HC $6.00 CSCL 06P

The operation of a system is described that is built both to model the vision of primate animals, including man, and serve as a pre-prototype of possible object recognition system. It was employed in a series of experiments to determine the practicability of matching left and right images of a scene to determine the range and form of objects. The experiments started with computer generated random-dot stereograms as inputs and progressed through random square stereograms to a real scene. The major problems were the elimination of spurious matches, between the left and right views, and the interpretation of ambiguous regions, on the left side of an object that can be viewed only by the left camera, and on the right side of an object that can be viewed only by the right camera. Author

N73-27937*# Florida State Univ., Tallahassee. Inst. of Molecular Biophysics.
RESEARCH IN PHOTOBIOLOGY AND PHOTOCHEMISTRY Final Report, 1964 - 1973
Hans Gaffron 18 Jul. 1973 22 p refs
(Grant NGR-10-004-018)
(NASA-CR-133459) Avail: NTIS HC $3.25 CSCL 06D

Publications are listed covering NASA research from 1966 to 1973. Several major works covering chloroplast reactions, aerobic green algae and hydrogenease, production of molecular hydrogen, and hydrogen and nitrogen metabolism in purple bacteria are summarized. E.H.W.

N73-27938*# Baylor Univ., Houston, Tex. Dept. of Microbiology and immunology.
PRODROMAL DISEASE: IMMUNE RESPONSES OF THE HOST MACROPHAGE SYSTEM TO HUMORAL FACTORS Final Report
B. S. Criswell and V. Knight Apr. 1973 115 p refs
(Grant NGR-44-003-044)
(NASA-CR-133455) Avail: NTIS HC $7.75 CSCL 06M

A composite is presented of nine studies, each yielding information contributing toward an understanding of methods designed to detect disease during the prodromal stages. The data further point to new areas of study that might be useful in early diagnoses. Five of the nine experiments were done in mice. Four of these involved acute infectious disease states and one involved a chronic autoimmune type disease. Of the numerous perimeters studied of the acute diseases, the uptake of H3- thymidine by peripheral blood lymphocytes appeared to yield the earliest indication of disease. This test was not useful in studying the chronic disease state. Four of the nine studies involved application of diagnostic technics to human disease. A normal baseline for H3-thymidine incorporation by human lymphocytes was determined. A subject with severe combined immunodeficiency disease was studied. A human volunteer study was done using Influenza A live attenuated vaccine. Finally, a human volunteer study of subjects infected with Influenza A was done. Author

N73-27939*# Battelle-Northwest, Richland, Wash.
MEASUREMENT OF RADIATION EXPOSURE OF ASTRONAUTS BY RADIOCHEMICAL TECHNIQUES Quarterly Research Report, 2 Oct. - 31 Dec. 1972
R. L. Brodzinski 15 Jan. 1973 20 p refs Sponsored in part by NASA
(Contract AT(45-1)-1830)
(NASA-CR-133378; BNWL-1183-13) Avail: NTIS HC $3.00

A cosmic radiation dose to the Apollo 16 crew of 180 + or - 100 mR was calculated from the specific activities of Na-22 and Na-24 in pre and postflight urine specimens. The specific activities of Cr-51 and Co-60 are higher in postflight specimens than in preflight specimens, presumably due to a postflight injection of radiochromium. The Fe-59 and Cs-137 specific activities are also reported and appear to be normal. The radiation doses received by a pilot and a navigator flying a high altitude mission during the solar flare of August 4 to 9, 1972 were calculated from the specific activity of Na-24 in their urine. These values are compared with the expected radiation dose calculated form the known shape and intensity of the proton spectrum. They demonstrate the magnitude of atmospheric shielding. Author

N73-27940# Institut Franco-Allemand de Recherches, St. Louis (France).
INFLUENCE OF PRESSURE RISE TIME OF AN N SHOCK WAVE, SIMULATING THE SONIC BOOM ON THE COCHLEAR AND ACOUSTICALLY EVOKED POTENTIALS OF THE GUINEA PIG [INFLUENCE DES TEMPS DE MONTEE EN PRESSION D'UNE ONDE EN N, SIMULANT LE BANG SONIQUE, SUR LES POTENTIELS COCHLEAIRES ET LES POTENTIELS EVOQUES AUDITIFS DU COBAYE]
A. Dancer and R. Franke 14 Sep. 1972 45 p refs In FRENCH
(Contract DRME-72/289)
(ISL-31/72) Avail: NTIS HC $4.25

The influence of pressure rise times of forward and backward fronts of N-type sound waves simulating sonic booms on the cochlea and acoustically evoke potential of the guinea pig were investigated. Experimental results have shown that at a given boom intensity, the front duration has an influence on the maxima amplitudes of cochlea and acoustically evoked potentials and, therefore, on the transmitted sound intensity. It was concluded that to characterize a sonic boom, it is necessary to determine not only its amplitude (or intensity) but also its forward and backward fronts. ESRO

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N73-27941* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ERGOMETER Patent
Raymond L. Gause and Bobby G. Bynum, inventors (to NASA) Issued 10 Jul. 1973 8 p Filed 29 Nov. 1971 Supersedes N72-20112 (10 - 11, p 1433)
(NASA-Case-MFS-21109-1; US-Patent-3,744,480; US-Patent-Appl-SN-202769; US-Patent-Class-128-2.05R; US-Patent-Class-73-379; US-Patent-Class-128-2.06R; US-Patent-Class-272-73) Avail: US Patent Office CSCL 06B

An ergometer is described that has a pedal driven direct current motor as a load and includes a frame for supporting the

body of a person in either a sitting or a prone position. The pedals may be operated by either the feet or the hands. The electrical circuitry of the ergometer includes means for limiting the load applied to the pedals as a function of work being performed, heart rate, and increases in heart rate.
Official Gazette of the U.S. Patent Office

N73-27942# Flying Personnel Research Committee, London (England).
COLOUR VISION REQUIREMENTS IN DIFFERENT OPERATIONAL ROLES IN THE ROYAL AIR FORCE
D. H. Brennan Nov. 1972 22 p ref
(FPRC/1319) Avail: NTIS HC $3.25

The importance of color vision in the various operational roles of the Royal Air Force has been studied. It is considered that good color discrimination, although playing a valuable part in the total process of visual parception, is not of paramount importance. With present standards, the lantern is the best trade test for grading color defectives as fit or unfit for aircrew duties. Author

N73-27943*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EVALUATION OF SOME SPECIAL TECHNIQUES FOR NUCLEAR WASTE DISPOSAL IN SPACE
John S. MacKay Aug. 1973 25 p refs
(NASA-TM-X-62272) Avail: NTIS HC $3.25 CSCL 06I

A preliminary examination is reported of several special ways for space disposal of nuclear waste material which utilize the radioactive heat in the waste to assist in the propulsion for deep space trajectories. These include use of the wastes in a thermoelectric generator (RTG) which operates an electric propulsion device and a radioisotope - thermal thruster which uses hydrogen or ammonia as the propellant. These propulsive devices are compared to the space tug and the space tug/solar electric propulsion combination for disposal of waste on a solar system escape trajectory. Such comparisons indicate that the waste-RTG approach has considerable potential provided the combined specific mass of the waste container - RTG system does not exceed approximately 150 kg/kw sub e. Several exploratory numerical calculations have been made for high earth orbit and Earth escape destinations. Author

N73-27944*# Minnesota Univ., St. Paul. Dept. of Food Science and Nutrition.
STORAGE STABILITY AND IMPROVEMENT OF INTERMEDIATE MOISTURE FOODS Final Report, 27 Mar. 1972 - 27 Mar. 1973
Theodore P. Labuza 17 Mar. 1973 277 p refs
(Contract NAS9-12560)
(NASA-CR-133978) Avail: NTIS HC $16.00 CSCL 06H

The rates of chemical reactions which deteriorate foods prepared to an intermediate moisture content and water activity (A sub w 0.6 to 0.9) were studied. The phenomenon of sorption hysteresis was used to prepare model systems and foods to similar A sub w's but different moisture levels so that the separate effects of water binding and water content could be elucidated. It was found that water content is the controlling factor for lipid oxidation in model systems comprised of a solid support and an oxidizable liquid. It was proposed that metal chelating agents like EDTA should give good protection to oxidation. EDTA exhibited the highest efficacy, about 10-15 times better than BHA which is a radical scavenger when studied in the model systems. Author

N73-27945*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
WASTE COLLECTION SUBSYSTEM DEVELOPMENT Technical Report, 1 Jul. 1971 - 31 Dec. 1972
Joseph E. Swider, Jr. Feb. 1973 146 p
(Contract NAS9-12150)
(NASA-CR-133977; SVHSER-6182) Avail: NTIS HC $9.50 CSCL 06I

Engineering studies, design activity and testing associated with the development of a waste collection system to accommodate both male and female crewmembers in a space environment are reported. Author

N73-27946*# Scientific Translation Service, Santa Barbara, Calif.
SPACE ERGONOMICS
A. I. Menshov Washington NASA Jul. 1973 499 p refs Transl. into ENGLISH of the book "Kosmicheskaya Ergonomika" Leningrad, Nauka Press, 1971 296 p
(Contract NASw-2035)
(NASA-TT-F-750) Avail: NTIS HC $6.00 CSCL 05H

Problems arising in connection with the quantitative analysis of the characteristics of the man-technology system are considered with respect to human working conditions in space vehicles. A detailed description is given of the characteristics and properties of man as a receiver of information, his throughput capacity, and his ability to withstand discomfort conditions during space flight. The ability with which the astronaut can carry out certain specific operations and functions is analyzed. The basic characteristics of methods for supporting the vital activity and fitness for work of astronauts are examined, together with the principles governing the construction of onboard systems. A methodology is given for quantitative analysis of the activity of the astronaut and the effectiveness of his work, utilizing the mathematical apparatus of queuing theory and the generalized criteria of operations research theory. It is shown that the task of finding the optimum distribution of functions between the crew and automated equipment can be solved. Author

N73-27947*# Linguistic Systems, Inc., Cambridge, Mass.
SIMPLIFIED METHOD OF MULTIPLE IMPLANTATION OF ELECTRODES IN THE SUBCORTICAL STRUCTURES OF THE BRAIN
V. N. Siderov Washington NASA Aug. 1973 8 p refs Transl. into ENGLISH from Zh. Vysshel Nervnoi Deyatelnosti (Moscow), v. 15, no. 5, 1965 p 943-946
(Contract NASw-2482)
(NASA-TT-F-15001) Avail: NTIS HC $3.00 CSCL 06B

A description is given of some special equipment that was constructed and used to implant electrodes in the cortical and subcortical structures of a cat's brain. The method uses a piece of plexiglass with holes cut in it as a template to guide a dentist's drill when drilling the holes for the electrodes. The method is simple and accurate and each implanation of electrodes into an animal provided useful information for many months.
Author

N73-27948*# AiResearch Mfg. Co., Los Angeles, Calif.
DEVELOPMENT OF DESIGN INFORMATION FOR MOLECULAR-SIEVE TYPE REGENERATIVE CO2-REMOVAL SYSTEMS
R. M. Wright, J. M. Ruder, V. B. Dunn, and K. C. Hwang Washington NASA Jul. 1973 254 p refs
(Contract NAS1-8559)
(NASA-CR-2277; Rept-72-8417) Avail: NTIS HC $3.00 CSCL 06K

Experimental and analytic studies were conducted with molecular sieve sorbents to provide basic design information, and to develop a system design technique for regenerable CO2-removal systems for manned spacecraft. Single sorbate equilibrium data were obtained over a wide range of conditions for CO2, water, nitrogen, and oxygen on several molecular sieve and silica gel sorbents. The coadsorption of CO2 with water preloads, and with oxygen and nitrogen was experimentally evaluated. Mass-transfer, and some limited heat-transfer performance evaluations were accomplished under representative operating conditions, including the coadsorption of CO2 and water. CO2-removal system performance prediction capability was derived. Author

N73-27949*# Essex Corp., Alexandria, Va.
APPLICATIONS OF SPACE TELEOPERATOR TECHNOLOGY TO THE PROBLEMS OF THE HANDICAPPED
Thomas B. Malone, Stanley Deutsch, Gustav Rubin, and Sheldon W. Shenk Jul. 1973 241 p Sponsored by NASA
(NASA-CR-133357) Avail: NTIS HC $14.25 CSCL 05H

The identification of feasible and practical applications of space teleoperator technology for the problems of the handicapped were studied. A teleoperator system is defined by NASA as a remotely controlled, cybernetic, man-machine system designed to extend and augment man's sensory, manipulative, and

locomotive capabilities. Based on a consideration of teleoperator systems, the scope of the study was limited to an investigation of these handicapped persons limited in sensory, manipulative, and locomotive capabilities. If the technology being developed for teleoperators has any direct application, it must be in these functional areas. Feasible and practical applications of teleoperator technology for the problems of the handicapped are described, and design criteria are presented with each application. A development plan is established to bring the application to the point of use. F.O.S.

N73-27950*# Virginia Univ., Charlottesville. Transportation Div.

ANALYSIS OF PASSENGER ACCEPTANCE OF COMMERCIAL FLIGHTS HAVING CHARACTERISTICS SIMILAR TO STOL

A. R. Kuhlthau and I. D. Jacobson Mar. 1973 37 p refs Presented at Flight Test Symp., Ottawa, 7-8 Mar. 1973
(Grant NGR-47-005-181)
(NASA-CR-132282; TR-403208) Avail: NTIS HC $4.00 CSCL 05E

Previous work in the development of quantitative models for the prediction of passenger reaction to motion and vehicle environment parameters in flight was extended to include a class of aircraft appropriate for low-density, short-haul service. The results indicate that it is possible to obtain quantitative response inputs from an usually small special test-subject group which will be representative of the general traveling public. Additional data which indicate the importance of comfort as a factor in evaluating ride quality was obtained, and identification of the factors which contribute to judgments regarding comfort level was improved. Seat comfort and seat spacing is very vital in the smaller aircraft. Mathematical modeling applied in conjuction with passenger reaction data was shown to be very useful for establishing ride-quality design criteria. Author

N73-27951# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. fuer Flugmedizin.

CURRENT SCIENTIFIC PAPERS FROM THE AEROSPACE MEDICAL INSTITUTE

K. E. Klein, comp. 2 Jan. 1973 253 p refs In GERMAN; ENGLISH summaries
(DLR-FB-73-15) Avail: NTIS HC $14.75; DFVLR, Porz, West Ger. 64 DM

Results of experimental research are reported. The following topics are dealt with: selection and work load of air crews, effects of transmeridian flights on circadian rhythms, vibration, acceleration, and weightlessness, effects, and hyperbaric and underwater medicine and technology. For individual titles, see N73-27952 through N73-27965.

N73-27952 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).

WING ANOMALIES OF THE FLOUR BEETLE TRIBOLIUM CONFUSUM CAUSED BY O-g SIMULATION

W. Briegleb, A. Schatz, J. Neubert, and F. Schuster *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 7-19 refs In GERMAN; ENGLISH summary Partly sponsored by Bundesmin. fuer Bildung und Wiss. (For availability see N73-27951 19-05)

The effects of weightlessness simulation in a centrifuge on the flour beetle Tribolium confusum was investigated. The beetles' eggs were cultivated in 4 mm tubes, and the results were examined after 3 generations. A highly significant morphogenetic effect with a radiomimetic character was observed. In particular, teratogene wing anomalies were observed, similar to a spontaneous mutation, and with similar characteristics as those of beetles flown in Biosatellite 2. ESRO

N73-27953 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).

A NEW METHOD TO RECORD HEART RATE AND RESPIRATORY RATE INFLIGHT ON COCKPIT CREWS

H. Bruener and H. Hohlweck *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 21-33 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

A method is described for inflight recording of heart and respiratory rate of pilots, by means of nose-clip transducers, in order to determine the total flight stress during short flights, and especially the psychophysical stress during take-off and landing. The sensors contain photo transistors for heart rate and NTC resistors for respiratory rate. The recording is done on a 12 decade printer at minute intervals. An example is given of a printout of heart and respiratory rate for pilot and co-pilot during approach and landing. ESRO

N73-27954 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).

RELATIONS BETWEEN SOCIOMETRIC VARIABLES AND CRITERIA OF PROFICIENCY OR BEHAVIOR OF STUDENT PILOTS

S. Fichtbauer *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 35-54 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

Some hypotheses about positive relations between sociometric variables (choice for group-leader, choice for friend, coherence of group) and criteria of proficiency or behavior (flying proficiency, application to duties, emotional stability) were tested on two samples of student pilots at a civil flight training center. The data from the first sample were gathered at the end of final training, the data from the second one at the end of an early phase of training. The hypotheses are only partly verified by the results of the study. Author (ESRO)

N73-27955 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).

A NEW METHOD TO SALVAGE SUNKEN SHIPS AND TO WORK UNDERWATER IN GREAT DEPTH

H. D. Fust *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 55-67 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

A method was developed for salvaging sunken bodies at great depth. The method combines diving bell and caisson techniques, and can be used to recover wrecks of maximally 20 m length, 4 m width, and 25 m height. An underwater crew compartment is foreseen for longer periods of work (6, 11, and 21 days). The first operation planned is salvaging a Viking ship at 5 m water depth, at the sea bottom. The problems of the application of this method at greater depth (30 to 50 m), in connection with an underwater station were investigated and observations were made concerning the safety measures necessary in case of long period work in an overpressure environment. ESRO

N73-27956 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).

PSYCHODIAGNOSTIC PROBLEMS IN THE SELECTION OF AVIATION PERSONNEL IN DEVELOPING COUNTRIES, TAKING APPLICANTS FROM YEMEN AS EXAMPLES [PSYCHODIAGNOSTISCHE PROBLEME BEI DER AUSLESE VON LUFTFAHRTPERSONAL IN ENTWICKLUNGSLAENDERN, DEMONSTRIERT AM BEISPIEL JEMENITISCHER BEWERBER FUER LUFTFAHRTHBERUFE]

K. M. Goeters *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 69-102 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

Forty three subjects applying for three aviation occupations (pilot, air traffic controller, and technician) from the developing Yemen Arabic Republic were tested with psychological tests for seven cognitive abilities and two personality traits. Problems of test selection application are discussed. Normative data and reliabilities of the tests are reported. The structure of the cognitive performances and of the personality scores are analysed (partially with the help of a factor analysis). The results of the investigation could be relevant to general problems of differential psychology. Author (ESRO)

N73-27957 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).

TASKS OF CONCENTRATION UNDER PSYCHICAL STRESS

H. Kirsch *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 103-115 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

Resulting factors of simple search and arithmetic problems were examined. The concentration stress test (CST) of Kirsch was applied. The test consisted of ten working columns, each of which is given one minute to work. Here the working times are changed so that initial working time is prolonged, while the working time for each column is steadily shortened. This resulted in an increasing time-stress which leads to a significant decrement of achievement below expected value with a sample of 300 applicants. Reliability and validity coefficients are given for the CST as a testing procedure in the selection of pilot applicants.
Author (ESRO)

N73-27958 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
RESYNCHRONIZATION OF DIURNAL PERFORMANCE RHYTHMS AFTER TRANSMERIDIAN FLIGHTS [DIE RESYNCHRONISATION DIANER LEISTUNGSRHYTMEN NACH TRANSMERIDIANEN FLUEGEN]
K. E. Klein and H. M. Wegmann *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 117-132 refs In GERMAN; ENGLISH summary Sponsored in part by US Air Force, Deut. Lufthansa, and Bundesmin. fuer Verteidigung (For availability see N73-27951 19-05)

The phase shifts in diurnal performance rhythms were observed in two groups of 8 students after transmeridian flights. It was found that the phase resynchronization takes between 4 to 5 days, is of an exponential character, and its speed is determined by the following factors: the direction of the flight (west-east resynchronization took longer than vice-versa), the nature of the tested biologic functions, and activity modes of the subject after the flight.
ESRO

N73-27959 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
EXTREME AEROEMBOLISM AND ITS SUCCESSFUL TREATMENT IN HYPERBARIC CHAMBER [EIN FALL VON ERFOLGREICHER UEBERDRUCKKAMMERTHERAPIE BEI MASSIVER LUFTEMBOLIE]
H. Oser *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 133-149 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

The successful treatment of a patient suffering from massive aeroembolism with ambient hyperbaric air is investigated. Such treatment was accomplished using a hyperbaric chamber which medical personnel could enter for care and control of the patient. The condition of the patient and the success of the therapy during the compression-, isopression- and decompression phase are described. Some criteria of the hyperbaric treatment are discussed and recompression-tables for the treatment of caisson disease are recommended. It is shown that even in nearly hopeless cases of aero-embolism a hyperbaric treatment can still be successful.
Author (ESRO)

N73-27960 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
THE GLUTAMIC ACID METABOLISM OF THE BRAIN AND ITS MODIFICATION THROUGH HYPERBARIC OXYGENATION
G. Schaffer *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 151-168 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

The relation between hyperbaric oxygenation and the functional activity of the differentiated brain is discussed with respect to an alteration of glutamic acid metabolism. In brain extracts the concentration of L-glutamic acid, gamma-amino-butyric acid (Gaba), and L-glutamine is significantly changed after breathing pure oxygen for about 70 hours. The reduction of the glutamic acid level occurring simultaneously with an increase of Gaba-concentration indicates an induction of inhibitory regulative mechanisms, whereas the elevation of the glutamine content seems to be an indication that larger amounts of ammonia are metabolized or detoxicated through O2 breathing.
Author (ESRO)

N73-27961 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
ELEMENTARY PHYSICS AND APPLICATION OF O-G SIMULATION ACCORDING TO H. J. MULLER
A. Schatz and W. Briegleb *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 169-182 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

The theory of weightlessness simulation is developed for a single body system and applied to a simple cell model. The conditions for good simulation are discussed and results show these conditions can be fulfilled without difficulties. Modifications of the model necessary for a further approximation to biology are described.
Author (ESRO)

N73-27962 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
DIAGNOSIS AND PROGNOSIS OF PILOT REACTION AND RESISTANCE TO PSYCHICAL STRESS [BEITRAG ZUR DIAGNOSTIK UND PROGNOSTIK DER PSYCHISCHEN BELASTBARKEIT DES PILOTEN]
K. Steininger *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 183-200 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

The prognosis of the resistance to any psychologically impairing stress is considered in view of its importance in selecting pilot applicants. The chance of predicting reliably enough such complex behavior as stress reactions depends on the more particular knowledge of the correlations between certain personality factors, the intensity of individually experienced feeling of stress, and the specific features of several psychical disorders. It should be possible to identify some personality factors as specific risk factors for the occurance of certain psychical failures or disorders. The state of knowledge and some methodical problems are discussed.
Author (ESRO)

N73-27963 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
INTERRELATIONSHIP BETWEEN GRAVITY AND MECHANICAL IMPEDANCE OF SUPINE HUMANS
L. Vogt, H. E. Krause (Dayton Univ. Res. Inst.), H. Hohlweck, and E. May *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 201-220 refs In GERMAN; ENGLISH summary Sponsored in part by NAS-NRC- and Bundesmin. fuer Bildung und Wiss. (For availability see N73-27951 19-05)

Measurements of the mechanical impedance of the supine human body under sustained acceleration were conducted to investigate the nonlinearities of the body system. A hydraulically driven shake table was installed on a centrifuge, and the transmitted force acceleration of the platform on which the subject was lying, were recorded. The results show that sustained acceleration stiffens the human body with increasing + G sub x and shifts the resonance to higher values. The results are explained by way of a multi-degree-of-freedom-system. This contributes to a better insight into the behavior of the human body under high amplitude vibration, buffering, and impact environments.
Author (ESRO)

N73-27964 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
CHANGES IN THE 24-HOUR RHYTHM AFTER TWO TRANSATLANTIC FLIGHTS IN RAPID SEQUENCE
H. M. Wegmann, K. E. Klein, and P. Kuklinski *In its* Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 221-235 refs In GERMAN; ENGLISH summary (For availability see N73-27951 19-05)

The effects of two transatlantic flights in rapid sequence upon the 24-hour rhythm of body functions and performance were studied in 8 male subjects. Studies were made of outgoing and return flights between Frankfurt and Chicago with a time shift of 6 hours and a stopover time of 26 hours. The results and their operational significance for flying personnel are discussed.
Author (ESRO)

N73-27965 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Bad Godesberg (West Germany).
EFFECT OF DEFINED SHOCK WAVES ON TEST ANIMALS [DIE WIRKUNG SPEZIELLER STOSSWELLEN AUF VERSUCHSTIERE]
In its Current Sci. Papers from the Aerospace Med. Inst. 2 Jan. 1973 p 237-252 refs In GERMAN; ENGLISH summary (For

availability see N73-27951 19-05)

In connection with the problems of high speed impact, the special effect of shock waves transmitted through different materials upon the organism of miniature pigs were investigated. In particular, those typical and reproducible injuries of organs which are caused by defined shock waves on predetermined body regions are described in detail. In discussing the morphological findings the particulars of the special damage effects were considered. Author (ESRO)

N73-27966# Institut Franco-Allemand de Recherches, St. Louis (France).

DETERMINATION OF LESION THRESHOLD IN THE GUINEA PIG AUDITORY AREA DUE TO SONIC BOOM [NIVEAU LESIONNEL DU BANG SONIQUE SUR L'APPAREIL AUDITIF DU COBAYE]

A. Dancer, R. Franke, G. Evrard, C. Zeller, and P. Massard 22 Nov. 1972 64 p refs In FRENCH

(Contract DRME-72/289)

(ISL-33/72) Avail: NTIS HC $5.25

The effects of the sonic boom intensity (20 to 50 mbar, 300 msec) and repetition frequency on the guinea pig auditory sensation areas, especially on eardrum and middle ear, were investigated. The histological study of the inner ear and audiometric tests have determined the lesion threshold of sonic booms at 30 mbar. A slight auditory perception loss was noticed after exposure to a sonic boom, and slight lesions of eardrum after exposure to frequent booms. ESRO

N73-27967# Coast Guard, Washington, D.C.

PACSAR 1972: REPORT OF THE PACIFIC INTERNATIONAL AIR AND SURFACE SEARCH AND RESCUE SEMINAR

1972 101 p refs Seminar held in San Francisco, 4-7 Dec. 1972

(AD-761756) Avail: NTIS CSCL 06/7

The seminar was concerned with the following elements of the new program: Communications; An inventory of available SAR facilities and their response time; Utilization of existing position reporting systems and existing ocean station vessels; The utilization of transient ships and aircraft in SAR operations; Expanding regional arrangements and setting up joint exercises among participating countries; The rescue of persons from ditched aircraft, drilling and production platforms and other special cases; The rescue of space personnel in emergency landings; and The rescue of persons trapped in submerged vehicles. GRA

N73-27968# Naval Postgraduate School, Monterey, Calif.

AN INTERACTIVE HYBRID COMPUTER SYSTEM FOR TIME DOMAIN AUDIO SYNTHESIS M.S. Thesis

James William Mizerski Mar. 1973 200 p refs

(AD-761730) Avail: NTIS CSCL 06/4

A time domain oriented technique using periodic functions composed of first order segments was employed in the development of a real-time interactive computer audio synthesis system. A general purpose analog computer was programmed to create non-monotonic function generators which are used to generate sequences of periodic functions that can be frequency and amplitude modulated. The system is appropriate for experiments in psychoacoustics. Exploration of the relationships between the physical and the perceptual significance of synthesis parameters of the technique is aided by real-time frequency analysis programs and an audio output capability. The system includes an interactive graphics terminal for conversational I/O and conventional peripheral devices for creating permanent records. Author (GRA)

N73-27969# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

TACTILE INFORMATION PRESENTATION (TIP)

David E. Thorburn and Richard L. Ravenelle Mar. 1973 13 p

(AF Proj. 7184)

(AD-761796; AMRL-TR-72-106) Avail: NTIS CSCL 05/5

The paper describes the Tactile Information Presentation (TIP), a device that avoids many of the disadvantages of previously proposed devices. The TIP produces a distinct tactile stimulus to the abdomen and thighs by inducing high pressure pulses of air into the pilot's anti-G suit. A special circuit senses a preset voltage from the angle-of-attack transmitter, accelerometer, or other sensors. This in turn triggers a low frequency oscillator which induces air pulses into the pilot's anti-G suit through a bypass around the standard anti-G valve. Experimental testing on a centrifuge has shown that, although the exact pulse frequency is not critical, three pulses per second provides a distinguishable stimulus under a variety of conditions. Although G-limit information can be presented by the TIP, angle-of-attack or maximum maneuvering alpha appear to be more useful information. Since a signal is obtained even when the G-suit is not inflated, landing angle-of-attack information could also be presented. This may be especially valuable in short-field or aircraft-carrier landings. Author (GRA)

N73-27970# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

BACKGROUND AND DEVELOPMENT OF BOYLE'S LAW ALTITUDE SUITS

J. D. Bowen Apr. 1973 52 p refs

(AD-761797; AMRL-TR-72-77) Avail: NTIS CSCL 06/17

All significant Aerospace Medical Research Laboratory (AMRL) investigations of design approaches and techniques applicable to emergency pressure suits for fliers during the 1960 to 1972 period are described and the results summarized. The first promising application of Boyle's Law; that is, the volume of a body of gas at constant temperature is inversely proportional to the absolute pressure, to the automatic pressurization of a suit was demonstrated at the School of Aerospace Medicine, Brooks AFB Tex., by Davis, Ritzinger, et al, in 1966. Subsequent efforts carried on by the AMRL are reviewed in sufficient detail to provide continuity and an overview of the program leading up to its termination at the Aerospace Medical Research Laboratory in the Spring of 1972 and transfer to the School of Aerospace Medicine at Brooks AFB, Texas. Final configurations that would fulfill all aircrew operational requirements are not fully developed. However, major progress was achieved in fabrication techniques and in the validation of features that should find application in a nearly optimum prototype approaching the real needs of the potential users. (Modified Author Abstract) GRA

N73-27971# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

TRACKING PERFORMANCE DURING WHOLE BODY VIBRATION WITH SIDE MOUNTED AND CENTER MOUNTED CONTROL STICKS

Richard W. Shoenberger and Darrell L. Wilburn Apr. 1973 19 p refs

(AF Proj. 7231)

(AD-761798; AMRL-TR-72-120) Avail: NTIS CSCL 05/5

To compare the relative susceptibility to vibration interference of a side-mounted control stick and a center-mounted control stick (both force-type, or isometric, controllers), pitch axis tracking performance was measured during sinusoidal whole-body Z-axis vibration. The tracking task had a dynamically unstable controlled element, which became increasingly unstable until the subject lost control. The tracking score was the highest level of instability at which control could be maintained. Subjects were seated upright and vibrated at plus or minus 0.4 g along the Z axis at frequencies of 2 Hz, 6 Hz, and 10 Hz. Results indicated that with either stick all freqyencies of vibration produced significant decrements in tracking performance, compared to the no-vibration control condition. There was no clear cut superiority of one stick location over the other, but which stick produced better performance was dependent upon the frequency of the vibration. The side stick was slightly better at 2 Hz, but the center stick was slightly better at 6 Hz and significantly better at 10 Hz. The large difference between the sticks at 10 Hz was attributed to the fact that for the side stick the input vibration is transmitted directly to the arm and hand via the arm rest, but for the center stick the input is from the seat, and at 10 Hz the amount transmitted to the hand is attenuated by the body. Author (GRA)

N73-27972# BioTechnology, Inc., Falls Church, Va.

A REVIEW OF PROBLEMS ENCOUNTERED IN THE RECOVERY OF NAVY AIRCREWMEN UNDER COMBAT CONDITIONS Final Report

Martin G. Every and James F. Parker, Jr. Jun. 1973 60 p

refs
(Contract N00014-72-C-0101; NR Proj. 105-667)
(AD-761636) Avail: NTIS CSCL 06/7

The purpose of the study was to examine Navy aviation combat casualty experiences in Southeast Asia and to assess the adequacy of the procedures and material utilized in rescue and recovery operations. Subjects consisted of naval aviators flying fixed-wing jet aircraft who had been forced to eject as a direct result of enemy action. One hundred and four survivors of such an occurrence were located and administered an extensive questionnaire covering the circumstances leading to the ejection, the state of the aircraft at the time of escape, and all events prior to and during rescue. The returned questionnaires provided a data base from which problems with survival procedures, survival equipment, and biomedical support were tabulated. Conclusions of the study deal with the adequacy of medical support procedures, aviation protective and survival equipment, and the rescue process itself. Author (GRA)

N73-27973# Naval Postgraduate School, Monterey, Calif.
ANALYSIS OF A DESCRIPTION MODEL FOR HAND MOTION DISTANCE IN A MANUAL DECISION TASK M.S. Thesis
Joseph Stanley Stewart, II Mar. 1973 56 p refs
(AD-761518) Avail: NTIS CSCL 05/10

An experimental investigation was conducted to examine a descriptive model for hand motion under discrete uncertainty of the stimulus set. The design and implementation of an automatic, on-line, data collection device using cyclegraphic motion collection methods is described. Eight subjects were exposed to 2.2 to 3 bits of choice uncertainty. Response times, error rates, and hand motion distances were collected and analyzed. Hand motion distances were compared to straight line distances used in control panel design. Further investigation indicated how the distributions of hand motion distances, for any stimulus, fit normal curves, and how variations in subject performance were significant. Perceptual aspects of the task and operator strategies are discussed. Further study is suggested. Author (GRA)

N73-27974# Coast Guard, San Francisco, Calif.
MLR/SERV (MOTOR LIFE BOAT/SURFACE EFFECT RESCUE VEHICLE) Operational Study Report, 1 Jan. - 1 Jun. 1973
15 Jun. 1973 100 p refs
(AD-761460; MLB-SERV-3960-02) Avail: NTIS CSCL 06/7

The United States Coast Guard has completed the final phase of an extensive operational study which combined the all weather capabilities of the Coast Guard built 44 foot Motor Life Boat (MLB) and the 70 knot amphibious capabilities of the Bell SK-5 Model Surface Effect Rescue Vehicle (SERV). The objectives of the study were to develop more accurate operational/maintenance cost data on the SERV so as to enable an objective comparison with other Coast Guard surface and air facilities. The second, and equally important part of the study was to examine the overall effectiveness of this unique dual response concept of operation and whether or not this concept had a useful application in meeting the Coast Guard's expanding Search and Rescue mission responsibility. The results of this final phase of study are documented. GRA

N73-27975# School of Aerospace Medicine, Brooks AFB, Tex.
HAZARD EVALUATION OF A GALLIUM ARSENIDE DIODE ARRAY LASER
James R. Gallagher and Peter C. Laudieri Jun. 1973 20 p refs
(AD-762277; SAM-TR-73-19) Avail: NTIS CSCL 06/18

The hazard of GaAs diode array lasers with their searchlight-like beams must be evaluated differently than conventional lasers. This report evaluates the ocular hazards of Solid State Laser, Type AN/AAQ-7, one of the GLINT series of illuminators. It was found that an optical density of 1.39 is required for protection within a distance of 22.4 m. from the laser for a 5-second exposure. Author (GRA)

N73-27976# Navy Clothing and Textile Research Unit, Natick, Mass.
DAMAGE CONTROL SUIT SYSTEM
Norman F. Audet, Dale A. Reins, and Arthur H. Chadwick May 1973 37 p refs
(AD-762428; TR-107) Avail: NTIS CSCL 06/11

A prototype damage-control-suit system (DCSS) was designed and fabricated as part of the Navy Clothing and Textile Research Unit's (NCTRU) continuing program to conduct feasibility and prototype development studies on personnel life-support clothing systems for protection against various environmental hazards. The DCSS consists of a life-support pack; an impermeable suit with headpiece, boots, and gloves, and a communication headset. (Modified Author Abstract) GRA

N73-27977# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
DESCRIPTION AND USE OF A MEASUREMENT SYSTEM FOR AIR BAG ACOUSTIC TRANSIENT DATA ACQUISITION AND ANALYSIS Final Report, Apr. 1971 - Jun. 1972
Henry C. Sommer Mar. 1973 42 p
(AD-761836; AMRL-TR-73-8) Avail: NTIS CSCL 13/12

In the development and test of air bag personal restraint systems for use in motor vehicles, various design concepts, sizes, and operations suggest that the impulsive noises may differ significantly in both maximum intensity and frequency content. A program was implemented whereby a portable impulse measurement system was acquired and the air bag noises generated by various systems being developed throughout industry were recorded and analyzed. GRA

N73-27978# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
AN ANNOTATED BIBLIOGRAPHY OF UNITED STATES AIR FORCE APPLIED PHYSICAL ANTHROPOLOGY Bibliography, Jan. 1946 - May 1972
Betty Reid May 1973 69 p refs
(AF Proj. 7184)
(AD-762287; AMRL-TR-73-51) Avail: NTIS CSCL 05/5

The report contains the titles, authors, publication/source information, and the abstracts of 132 technical reports and articles published by Anthropology Branch of the Aerospace Medical Research Laboratory between January 1946 and May 1973. It is a detailed document of the scope of the effort of the Air Force in the field of applied physical anthropology to provide the information on human body size and biomechanical characteristics of Air Force personnel required for the development and evaluation of Air Force systems, personal-protective equipment and clothing. Work in the following areas is described: Anthropometry; workspace; biomechanics; and sizing and designing of personal equipment. (Modified Author Abstract) GRA

N73-27979# Goodyear Aerospace Corp., Akron, Ohio.
EFFECT OF TRAINING ON COORDINATE DETERMINATION OF SLAR (SIDE-LOOKING AIRBORNE RADAR) IMAGED FEATURES
R. Kause, J. A. Thomas, and T. E. Jeffrey (Army Res. Inst. for the Behavioral and Soc. Sci.) Apr. 1973 52 p refs
(Contract DAHC19-67-C-0051; DA Proj. 2Q6-62704-A-721)
(AD-762342; ARI-TRW-235) Avail: NTIS CSCL 17/9

Research was conducted dealing with the development and evaluation of a training program to improve the performance of operators in locating targets in side-looking airborne radar (SLAR) imagery. The primary objective of the study was to develop a trainee-participation instructional program with immediate feedback and to assess its effectiveness in enhancing image interpreter performance with respect to accuracy in locating and identifying map coordinates of detected targets. (Modified Author Abstract) GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g. spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N73-27980* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PREPARATION OF POLYIMIDES FROM MIXTURES OF

MONOMERIC DIAMINES AND ESTERS OF POLYCARBOXYLIC ACIDS Patent
Tito T. Serafini, Peter Delvigs, and George R. Lightsey, inventors (to NASA) Issued 10 Jul. 1973 6 p Filed 29 Sep. 1971 Supersedes N72-10134 (10 - 01, p 0021)
(NASA-Case-LEW-11325-1; US-Patent-3,745,149; US-Patent-Appl-SN-184960; US-Patent-Class-260-65; US-Patent-Class-117-161P; US-Patent-Class-117-161UN; US-Patent-Class-117-228; US-Patent-Class-161-214; US-Patent-Class-161-227; US-Patent-Class-260-30.2; US-Patent-Class-260-30.8DS; US-Patent-Class-260-32.6N; US-Patent-Class-260-33.4R; US-Patent-Class-260-33.6R; US-Patent-Class-260-47CP; US-Patent-Class-260-78TF; US-Patent-Class-260-78UA) Avail: US Patent Office

Polyimides having high thermal and oxidative stability are prepared by the reaction of a mixture of monomers comprising (1) a dialkyl or tetraalkyl ester of an aromatic tetracarboxylic acid; (2) an aromatic diamine; and (3) a monoalkyl or dialkyl ester of a dicarboxylic acid where in the ratio of a:b:c is n:(n+1):2, wherein n has a value from 1 to 20. The mixture of monomers is prepared in a 30 to 70 percent by weight solution of an organic solvent, a substrate impregnated with the solution and heated at 50 to 205 C to remove said solvent and form a low molecular weight prepolymer, and thereafter heated at 275 to 350 C to cure to a high molecular weight polyimide.
Official Gazette of the U.S. Patent Office

N73-27981 Illinois Univ., Urbana.
CHEMICALLY REACTING BOUNDARY LAYER OVER A VAPORIZING SURFACE Ph.D. Thesis
Harold Kerzner 1972 335 p
Avail: Univ. Microfilms Order No. 73-9967

The laminar chemically reacting boundary layer with thermodynamic coupling at the solid fuel-gas interface was analyzed for a variety of cases of stoichiometry, energy feedback and pressure gradients. The concept of a thin diffusion type flame was extensively utilized in these analyses. The major parameter predicted was the regression rate of the solid fuel as a function of free stream conditions, since for hybrid rocket combustion the fuel mass burning rate is determined by those known conditions. Favorable comparisons were found between the present work and other experimental studies. The heat feedback parameter was then found to have an important effect on the predicted values of wall blowing rate and wall shear stress.
Dissert. Abstr.

N73-27982 New York Univ., N.Y.
NEW DURABLE FLAME RETARDANT TREATMENTS FOR NATURAL AND SYNTHETIC FABRICS Ph.D. Thesis
Arnold S. Adler 1972 165 p
Avail: Univ. Microfilms Order No. 73-9062

Experimental investigations are described leading to the preparation and evaluation of novel flame retardant treatments for cotton fabrics. Exploratory data relating to analogous flame retardant treatments for polypropylene fibers are also presented. Cotton fabrics were treated with selected flame retardent compositions by immersion in a pad bath using conventional textile processing technology to obtain various treatment addons. The treated fabrics were then evaluated for flammability with the limiting oxygen index flammability test. Durability of the treatments, physical strength properties, esthetics etc., were also studied. Fiber reactive flame retardant systems were found to exhibit a significantly more attractive balance of properties particularly as regards durability, compared to analogously formulated compositions which did not feature fiber reactivity but relied only on mechanical adhesion. Fiber reactivity was achieved by including groups reactive to cellulose in the flame retardant systems. These groups could be activated by electron beam irradiation and/or thermal treatments. Dissert. Abstr.

N73-27983*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
TRACE ORGANIC IMPURITIES IN GASEOUS HELIUM
Thomas A. Schehl Washington Aug. 1973 19 p refs
(NASA-TN-D-6520) Avail: NTIS HC $3.00 CSCL 07C

A program to determine trace organic impurities present in helium has been initiated. The impurities were concentrated in a cryogenic trap to permit detection and identification by a gas chromatographic-mass spectrometric technique. Gaseous helium (GHe) exhibited 63 GC flame ionization response peaks. Relative GC peak heights and identifications of 25 major impurities by their mass spectra are given. As an aid to further investigation, identities are proposed for 16 other components, and their mass spectra are given. Author

N73-27984# Bhabha Atomic Research Centre, Bombay (India).
[SCANNING SPECTROMETER AND SURFACE BARRIER SILICON DETECTOR FOR RADIOCHEMICAL RESEARCH]
R. H. Iyer and M. V. Ramaniah 1972 190 p refs
(BARC-628) Avail: NTIS

A scanning spectrometer for accurate measurements of fluorescence intensities for studies pertaining to energy migration in crystals and solutions of rare earths and actinides is described. Also, a surface barrier silicon detector for low geometry alpha counting is briefly described. NSA

N73-27985# Oak Ridge National Lab., Tenn.
STUDY OF CORRELATED THERMALLY ACTIVATED POLARIZATION, CONDUCTION, AND LUMINESCENCE EFFECTS IN LITHIUM FLUORIDE AS FUNCTIONS OF IRRADIATION, DOPING, AND THERMAL HISTORY Ph.D. Thesis - Wisconsin Univ.
D. E. Fields and P. R. Moran Mar. 1973 87 p refs
(Contract W-7405-eng-26)
(ONRL-4850) Avail: NTIS HC $3.00

Three related phases of investigations of electrical and luminescence phenomena in pure and doped lithium fluoride are described. First, the simple trapped carrier-free carrier recombination model often used to describe thermoluminescence and thermally activated conductivity experiments is considered. Next, a study is made of thermally activated polarization and thermally activated depolarization effects resulting from impurity-vacancy dipole reorientation in Mg doped and undoped lithium fluoride in the temperature region 200 to 250 K. These results are compared to earlier measurements of a radiation-induced thermally activated depolarization. Finally, initial observations of a new radiation-induced phenomenon in LiF are reported; a large permanent electrical polarization can be induced in LiF by ionizing radiation. Specific radiation-induced polarizations, after thermal depolarization, can be regenerated optically but not by thermal repolarization. Author (NSA)

N73-27986# California Univ., Livermore. Lawrence Livermore Lab.
NEW EQUATION OF STATE FOR HYDROGEN
R. J. Olness, H. C. Graboske, Jr., and W. G. Hoover 2 Jun. 1972 19 p refs
(UCID-16095) Avail: NTIS HC $3.00

The new hydrogen equations of state introduced within the last few months are described including the low temperature region. NSA

N73-27987# California Univ., La Jolla. Dept. of Physics.
A THEORY OF THE DYNAMIC STRUCTURE FACTOR IN SIMPLE LIQUIDS, 1
M. Rao May 1973 35 p refs Sponsored in part by NSF
(Contract N00014-69-A-0200-6026; NR Proj. 017-653)
(AD-761659; TR-19) Avail: NTIS CSCL 07/4

A theory of the Dynamic Structure Factor S(k, omega) is presented for a classical liquid. A perturbation scheme is developed for both the coherent and incoherent dynamic structure factors in a high effective frequency regime. The expansion scheme converges for soft-core interaction potentials as long as omega (eff) is much greater than a characteristic frequency omega of the liquid. The expansion scheme is valid for an arbitrary density of the liquid. Unlike the conventional high frequency expansion this theory is valid even for small omega as long as the momentum transfer k is large. (Modified Author Abstract)
GRA

N73-27988# Northeastern Univ., Boston, Mass. Dept. of Chemistry.
STUDY OF THE INTERFACIAL PROPERTIES OF WATER BY GAS CHROMATOGRAPHY Final Report
Barry L. Karger 1 Jun. 1973 26 p refs
(Contract N00014-68-A-0207; NR Proj. 051-496)

(AD-761655) Avail: NTIS CSCL 07/4

A summary of work on the interfacial properties of water by gas chromatography is presented. In this method the retention of nonelectrolytes is measured. For some solutes only adsorption at the gas-liquid interface occurs whereas for others both adsorption and partition simultaneously take place. The results indicate that bulk water is a low energy surface to hydrocarbons. It is also shown for the first time that there is a formation of hydrogen bond interactions between water surface molecules and bronsted bases. In terms of partition, the results indicate that water coated in thin layers on wide-pore silica is similar to bulk water in its solvent properties. Also presented are results on the interfacial properties of sodium chloride solutions. In general, the adsorption coefficient of nonelectrolytes increases as NaCl concentration increases. However, a definite minimum in adsorption coefficient for many solutes is found at 0.50 molal NaCl. Also measured were salting-out constants. The study has developed gas chromatography to the point that it can be successfully used in the study of electrolyte solutions. (Modified Author Abstract) GRA

N73-27989# Technology, Inc., Dayton, Ohio.
AN APPLICATION OF LASER-RAMAN-SPECTROSCOPY TO THERMOCHEMICAL MEASUREMENTS IN AN ARC-HEATED WIND TUNNEL FLOW Final Report
Anthony A. Boiarski and Fred L. Daum Dec. 1972 94 p refs
(Contract F33615-71-C-1463; AF Proj. 7065)
(AD-761500; ARL-72-0126) Avail: NTIS CSCL 07/4

Laser Raman Scattering (LRS) has been investigated as a possible approach toward providing a nonperturbing flow calibration method for arc-heated wind tunnel facilities. Such a calibration is needed to evaluate the chemical and thermodynamic properties of the high temperature air flow which cannot be accurately determined using standard probe techniques. Theoretical calculations showed that the number densities and vibrational temperatures of nitrogen, oxygen, and nitric oxide could be obtained using the Raman spectroscopic method. Exploratory experimental LRS results obtained in the Air Force Flight Dynamics Laboratory 50-Megawatt Reentry Nose Tip (RENT) Facility showed that it is indeed feasible to apply LRS to arch-tunnel flow diagnostics. Author (GRA)

N73-27990# Naval Research Lab., Washington, D.C.
PHOTONUCLEAR ACTIVATION ANALYSIS WITH Ge(Li) DETECTORS. COMPILATION 2 Interim Report
M. Elaine Toms 9 May 1973 99 p refs
(NRL Proj. H01-09; RR0020641)
(AD-761992; NRL-7591) Avail: NTIS CSCL 07/4

High-energy bremsstrahlung, variable up to about 60 MeV, from high-intensity electron linacs can produce activation through a variety of photonuclear reactions. A great range of activities by half-lives can be used. Some discrimination between target elements can be obtained through the choice of bremsstrahlung endpoint energy. The high resolution of Ge(Li) gamma-ray spectrometers permits much of the analysis to be accomplished without chemical separation of resulting nuclei; hence nondestructive analysis can be applied to many materials. To facilitate the use of such analysis, a compilation of photonuclear reactions with their resulting gamma-rays has been prepared, supplementing the compilation for activities with half-lives from 100 microsec to 24 hours given in NRL Report 7554. This second compilation is for activities with half-lives from 24 hours to 1 year and again consists of two tabulations. Table 1-S lists the photonuclear reactions by target nuclei. Table 2D and 2E, the final two parts of Table 2, list the reactions by gamma-ray energies: Table 2D is for half-lives from 24 hours to 30 days, and Table 2E is for half-lives from 30 days to 1 year. Author (GRA)

N73-27991# Florida Univ., Gainesville. Coll. of Engineering.
A CROSSED-BEAMS TANDEM MASS SPECTROMETER FOR STUDIES OF LOW ENERGY IONIC COLLISIONS
J. M. Mullen, N. R. Richardson, C. L. Bottoms, T. L. Bailey, N. R. Richardson, C. L. Bottoms, and T. L. Bailey May 1973 91 p refs
(Contract N00014-68-A-0173-0012; NR Proj. 012-102; NR Proj. 012-102)
(AD-762450; TR-6) Avail: NTIS CSCL 07/4

The report describes the design, construction, and performance of the crossed-beams, longitudinal extraction, tandem mass spectrometer, LEICA. The function of LEICA is to measure total cross sections for reactive ion-neutral processes at relatively low energies (around 100 eV, to less than 1 eV in the laboratory frame), and under conditions of high collision-energy resolution. Primary ions are velocity selected after mass analysis, and have a K.E. bandwidth of as small as plus or minus 0.1 eV. Target molecules are introduced as a modulated effusive beam, which intersects the beam of primary ions at 90 deg. For reactive processes having favorable kinematics, this apparatus gives quite high K.E. resolution. As example, the reaction Ar(+) + D2 = ArD(+) + D was studied. The results of preliminary total cross section measurements for the reaction H2(+) + H2O = H2O(+) + (undetected products) are presented. Several electronic circuits (which were designed and constructed specifically for LEICA, but which may be of general interest) are described.
Author

N73-27992# School of Aerospace Medicine, Brooks AFB, Tex.
CONTAMINANT ANALYSIS OF CHLORATE-CANDLE GENERATED OXYGEN Progress Report, Dec. 1971 - Dec. 1972
Robert J. Reyes, Edward J. Fruin, James P. Vasil, and Richard L. Miller May 1973 19 p refs
(AF Proj. 7164)
(AD-762276; SAM-TR-73-10) Avail: NTIS CSCL 07/4

Chlorate-candle generated oxygen has been analyzed for both type and degree of contamination. Data and methods of analysis are presented for chlorine, carbon monoxide, carbon dioxide, and hydrocarbon levels in chlorate oxygen. Some emphasis has been placed on chlorine analysis because of the highly toxic nature of the gas; the technic for this analysis is a newly proposed method, developed in this laboratory, which allows continuous monitoring of chlorate oxygen during its generation.
Author (GRA)

N73-27993# Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
MOLECULAR MECHANISMS OF CONDUCTION AND POLARIZATION IN WATER VAPOR, LIQUID WATER AND ICE
Arthur R. vonHippel May 1973 33 p refs
(Contract N00014-67-A-0204-0053; NR Proj. 105-632)
(AD-762060; TR-12) Avail: NTIS CSCL 07/4

After a short review of the pertinent prehistory, the investigation starts with water vapor. Thermal ionization requires formation of special association complexes and their dissociation by infrared vibrations. The corresponding process occurs in water and is being analyzed in detail. Proton tunneling appears interdicted by a 'proton polaron' effect. The dielectric polarization for water and for ice is of very different origin as their temperature dependence clarifies; the former is correlated to the break-up of a gaseous tetrahedral structure, the latter is initiated by a quantum transition. Ice proves not to be a proton semiconductor; perfect ice crystals seem to be insulators. The results of previous observers have been falsified by multicrystallinity and insufficient time scales of observation. Author (GRA)

N73-27994# Naval Research Lab., Washington, D.C.
DEVELOPMENT OF X-RAY FLUORESCENCE SPECTROSCOPY FOR ELEMENTAL ANALYSIS OF PARTICULATE MATTER IN THE ATMOSPHERE AND IN SOURCE EMISSIONS. PHASE 2: EVALUATION OF COMMERCIAL MULTIPLE CRYSTAL SPECTROMETER INSTRUMENTS Final Report
L. S. Birks and J. V. Gilfrich 15 Jun. 1973 15 p refs Prepared for the Environmental Protection Agency, Washington, D. C.
(AD-762061; NRL-7617; EPA-R2-72-063; PB-213366) Avail: NTIS CSCL 07/4

Four commercial multiple crystal spectrometer x-ray analyzers were evaluated for use in the elemental analysis of air pollution particulate samples. Fourteen to twenty-four elements can be measured simultaneously in these instruments. 100 second detection limits of 1 to 10 ng/sq cm were achieved for about one-half of the elements examined. Any one of the commercial instruments is capable of performing quantitative analysis of the particulate matter filtered out of the atmosphere or source

emissions. Some actual pollution samples were analyzed in all four instruments to demonstrate suitability. Author (GRA)

N73-27995# California Univ., La Jolla. Dept. of Chemistry.
A STUDY OF THE SENSITIVITY OF COUPLED REACTION SYSTEMS TO UNCERTAINTIES IN RATE COEFFICIENTS 1: THEORY
R. I. Cukier, C. M. Fortuin, K. E. Shuler, A. G. Petschek, and J. H. Schaibly 18 Jan. 1973 23 p refs
(Contracts N00014-69-A-0200-6018; N00014-71-C-0347; ARPA Order 1806)
(AD-762420; TR-14) Avail: NTIS CSCL 07/4

A method has been developed to investigate the sensitivity of the solutions of large sets of coupled, non-linear rate equations to uncertainties in the rate coefficients. This method is based on varying all the rate coefficients simultaneously through the introduction of a parameter in such a way that the output concentrations become periodic functions of this parameter at any given time t. The concentration of the chemical species are then Fourier analysed at time t. The authors show via an application of Weyl's ergodic theorem that a subset of the Fourier coefficients is related to the rate of change of the concentration of species i with respect to the l rate constant for reaction l averaged over the uncertainties of all the other rate coefficients. The Fourier method developed is not limited to chemical rate equation, but can be applied to the study of the sensitivity of any large system of coupled, non-linear differential equations with respect to the uncertainties in the modeling parameters. (Modified Author Abstract) GRA

N73-27996# California Univ., La Jolla. Dept. of Chemistry.
A STUDY OF THE SENSITIVITY OF COUPLED REACTION SYSTEMS TO UNCERTAINTIES IN RATE COEFFICIENTS. 2: APPLICATIONS
John H. Schaibly and Kurt E. Shuler 7 Jun. 1973 36 p refs
(Contract N00014-69-A-0200-6018; ARPA Order 1806)
(AD-762421; TR-15) Avail: NTIS CSCL 07/4

The Fourier amplitude method developed in (AD-762420) as a diagnostic tool for determining the sensitivity of the results of complex calculations to the parameters which enter these calculations has been applied to two chemical reaction systems involving sets of coupled, nonlinear rate equations. These were: (a) a 5 reaction set describing the high temperature (6000K) dissociation of air and (b) a 9 reaction set describing the constant temperature (2000K) combustion of H2 and O2. The authors have evaluated the Fourier amplitudes for all the species at a number of different times for both reaction systems. The analysis of these results verifies the claims made in the previous report. The conclusions based on the Fourier amplitude method for these two reaction systems are in excellent agreement with sensitivity predictions which could be made on the basis of previous kinetic studies of these systems. Author (GRA)

N73-27997# Calspan Corp., Buffalo, N.Y.
URANIUM-OXYGEN RADIATION STUDIES Semiannual Technical Report, 16 Jul. 1972 - 15 Jan. 1973
Walter H. Wurster Apr. 1973 22 p refs
(Contract DNA001-72-C-0098; ARPA Order 1433)
(AD-762430; WB-5117-A-2; DNA-3046Z; SATR-2) Avail: NTIS CSCL 07/4

The report is the second semi-annual technical report on a research program whose objectives are to measure absolute spectral radiances from uranium-oxygen mixtures. The measurements are made under controlled conditions of temperature and species concentrations, and include infrared data between 8 and 14 micrometers. The final objective of the program is to provide a sufficiently broad data base to permit the specification of equilibrium radiation from uranium oxides for the conditions of interest to ARPA objectives. To date, the first task of the research effort has been addressed, namely, an assessment of the applicability of the exploding-wire-aerosol shock tube technique to the problem. Aerosol distribution and vaporization times have been measured. Successful IR measurements (12-14 micrometers) of a U-O2 test mixture have been made. The use of UF6 as a means to calibrate uranium concentrations in the shock tube was extensively tested and found inapplicable. A shock tube modification for more uniform aerosol distribution has been incorporated and will be tested shortly. In addition, the LWIR radiometer has been upgraded for increased sensitivity. (Modified Author Abstract) GRA

N73-27998# Army Foreign Science and Technology Center, Charlottesville, Va.
ASPIRATION OF AEROSOL SAMPLES FROM A FLOW BY USING ZERO INTAKE TUBES
S. P. Belyaev 20 May 1972 14 p refs Transl. into ENGLISH from Fiz. Aerosolei, Eksperim. Ustanovki i Pribory (USSR), no 7, 1967 p 74-82
(AD-762329; FSTC-HT-23-1733-72) Avail: NTIS CSCL 07/4

In working with particulate aerosols it is almost always necessary to know the weight concentration of impurity. The accepted method of measuring the weight concentration is to withdraw a portion of the flow by using an intake tube. It is known, however, that as aspiration proceeds, changes of concentration and range of particle sizes arise in the intake tube, in comparison with the concentration and range in the main flow. Results of a study of a zero type intake tube are given. It is shown what kind of conditions make the coefficient of isokineticity varies only slightly when the inflow rate changes. The need for introducing a new correction coefficient allowing for the shape of the tube is explained. A technique is suggested for calibrating zero intake tubes which provides maintenance of isokineticity during withdrawal of the samples. Formulae are recommended for choosing the basic structural dimensions of an intake tube of this type. GRA

N73-27999# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEPENDENCY OF VISCOSITY OF LIQUIDS ON PRESSURE
E. V. Zolotykh, Yu. T. Bukharov, and E. I. Kuznetsov 22 May 1973 26 p refs Transl. into ENGLISH from Tr. Vses. Nauchn. Issled. Inst. Fiz.-Tekhn. Radiotekhn. Izmerenii (USSR), v. 164, no. 104, 1969 p 56-73
(AD-761590; FTD-MT-24-1322-72) Avail: NTIS CSCL 07/4

The investigation of each liquid included: The determination of the dependence of viscosity and density of a liquid on temperature at atmospheric pressure; The measurement of the solidification pressure of the liquid at different temperatures; and The measurement of viscosity as a function of pressure at several fixed temperatures. The investigation was conducted for several silicone liquids (polymethylsiloxane liquids (PMS), polyethylsiloxane liquid No. 5, PFMS-2 and FM-1322/300 fluids) and for VM-1 mineral oil and mixtures of different concentrations of it with gasoline. GRA

N73-28000# ARO, Inc., Arnold Air Force Station, Tenn.
OPTICAL ELECTRON EXCITATION CROSS-SECTION MEASUREMENT OF THE N2(PLUS) FIRST NEGATIVE SYSTEM AT ELEVATED TEMPERATURES Final Report, May 1971 - May 1972
J. W. L. Lewis, L. L. Price, and H. M. Powell AEDC Jun. 1973 79 p refs
(ARO Proj. VT0118)
(AD-762257; ARO-VKF-TR-72-175; AEDC-TR-73-28) Avail: NTIS CSCL 07/4

Optical electron excitation cross sections of bands of the -2 and -3 sequences of the N2 (+) First Negative System of N2 were measured over the temperature range from 300 to 900K. The apparent electron excitation cross sections of the v = 1, 2, 3, and 4 levels, normalized to the v = 0 level, were determined, and enhancement of the experimental values of sigma (v > or = 2) relative to the predicted values was found for all temperatures investigated. Possible causes of the enhancement and its decrease with increasing temperature are discussed. Author (GRA)

N73-28001# Monsanto Research Corp., St. Louis, Mo.
THE RHEOLOGY OF CONCENTRATED SUSPENSIONS OF FIBERS AND SPHERES
R. O. Maschmeyer and C. T. Hill May 1973 20 p refs
(Contract N0001-67-C-0218; ARPA Order 876)
(AD-762083; HPC-73-161) Avail: NTIS CSCL 07/4

Processability of short fiber reinforced plastics is determined in part by their rheological properties in the melt or prepolymer state. The rheological properties depend in turn on material

properties such as matrix rheology; fiber length; stiffness, and strength; volume fraction of fibers or other fillers; and nature and amount of third phases. The rheological properties also depend upon shear rate, fiber orientation, and the geometry of the flow channel. The authors review and summarize the (sparse) existing scientific and technical literature on the viscosity and elasticity of concentrated fiber suspensions, including reinforced plastics. They also discuss their own experimental capillary rheometry of model suspensions of 1/8 inch glass fibers in viscous silicone oils. At high volume fraction fibers such suspensions are pseudoplastic, exhibit a yield stress in shear, have large capillary entrance corrections, but show no die swell. A brief account is given of the influence of fiber breakage on suspension viscosity in capillary flow and on the best choice of technique for mixing such suspensions. Author (GRA)

N73-28002# Air Force Academy, Colo. Dept. of Aeronautics.
ROTATIONAL TEMPERATURE MEASUREMENTS IN FLOWING NITROGEN DISCHARGES BY SIDELIGHT SPECTROSCOPY Technical Report, Jul. 1972 - Jan. 1973
Norman F. Roderick May 1973 98 p refs
(AD-762290; DFAN-TR-73-1) Avail: NTIS CSCL 07/4

A technique using sidelight spectroscopy has been developed to obtain rotational temperatures and radial rotational temperature profiles in flowing gas discharges containing nitrogen similar to those used in gas discharge lasers. The experimental technique uses the relative intensities of the 3805A band of the second positive system of N2. Computer codes for obtaining both average temperatures and temperature profiles from chord wise scans of intensities have been developed. Preliminary results indicate the expected increase in temperature for increasing current and/or pressure for high nitrogen partial pressures. For lower pressures standing striations in the column appear to produce a marked local variation in longitudinal rotational temperature. Radial temperature profiles show an off axis temperature maximum as opposed to the theoretically predicted on axis maximum.
Author (GRA)

N73-28003# Ballistic Research Labs., Aberdeen Proving Ground, Md.
INTERFEROMETRY IN THE FAR UV: PHOTOMETRIC ASPECTS
Edmund J. Gion May 1973 24 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-762151; BRL-MR-2295) Avail: NTIS CSCL 07/4

The report points up the intensity problems associated with optical interferometry in the far ultraviolet. A specific system as used in the hook method of Roschdestvensky is treated, and results are given of hypothetical film darkening upon exposure to black body sources at temperatures from 10,000-50,000K. The example illustrates the marked superiority of proper reflective coatings for the far UV, over large increases of source temperature, with ordinary reflective coatings. Author (GRA)

N73-28004# ARO, Inc., Arnold Air Force Station, Tenn.
MASS SPECTROMETRIC SAMPLING OF THE FREE-JET EXPANSIONS OF GAS MIXTURES Final Report, 3 Feb. 1971 - 5 May 1972
A. B. Bailey AEDC Jun. 1973 49 p refs Sponsored by AEDC
(AD-761811; ARO-VKF-TR-73-34; AEDC-TR-73-88) Avail: NTIS CSCL 07/4

To achieve a better understanding of the composition of the upper atmosphere, it is necessary to obtain more information on the reaction kinetics of cluster ions. The purpose of the present investigation has been to determine the feasibility of producing mixed molecular clusters in the free-jet expansions of a variety of gas mixtures. Mass spectra have been obtained from cluster beams formed by the expansions of water vapor, steam, sulfur dioxide, nitric oxide, water/sulfur dioxide, water/nitric oxide, water/sulfur dioxide/nitrogen, water/sulfur dioxide/Argon, and water/sulfur dioxide/nitric oxide. The cluster ions observed are described. (Modified Author Abstract) GRA

N73-28005# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTING A DISK ATOMIZER FOR STRAIGHT-THROUGH DRYERS
O. V. Kozlovskii 8 Jun. 1973 11 p refs Transl. into ENGLISH from Tr. Volo. Molochvyi Inst. Tekhnologicheskii Fakultet (USSR), 1966 p 103-108
(AD-762221; FTD-HT-23-350-73) Avail: NTIS CSCL 07/1

The particle dispersion process in the region of the drying space is simulated. The Cook formula reflects with a sufficient degree of accuracy the nature of particles dispersion, but it does not consider the effect of the medium. The movement of the zone of maximal mist concentrations can be explained on the basis of the experimental data by the influence of the medium and the leading influence of large particles on small particles. Spray density measurements taken in individual experiments deviated insignificantly from average values. Thus the proposed method can be used to test new sprayer designs. GRA

N73-28006# Carnegie-Mellon Univ., Pittsburgh, Pa. Mellon Inst. of Science.
RESEARCH AND DEVELOPMENT ON THE ANALYSIS AND CHARACTERIZATION OF EXPERIMENTAL MATERIALS Final Report, 1 Jan. 1971 - 31 Dec. 1972
Gerald L. Carlson Feb. 1973 63 p refs
(Contract F33615-71-C-1157; AF Proj. 7360)
(AD-762303; AFML-TR-73-33) Avail: NTIS CSCL 07/4

The goal of the research program was to supplement and enhance the capabilities of the Air Force Materials Laboratory in the analysis and characterization of exploratory materials. This goal was achieved through studies aimed at expanding the analytical utility of Raman and far infrared spectroscopy, the development of new techniques for spectroscopic analysis, and supporting research on analytical problems and analysis of unknown samples. The report briefly describes this research. Far infrared group frequencies for several classes of compounds were correlated and the usefulness of O-H and N-H torsional frequencies in providing new knowledge on intramolecular forces and chemical reactivity has been suggested. The evaluation of new instrumentation was a significant contribution of this program. The far infrared performance of an innovative Fourier transform spectrometer was tested and improved. The majority of the report presents characteristic Raman frequencies for various compounds. GRA

N73-28007# Massachusetts Univ., Amherst. Dept. of Chemical Engineering.
CHEMILUMINESCENCE FROM METALS AND METAL OXIDES. A STUDY OF CHEMILUMINESCENCE FROM TRIMETHYLALUMINUM, IRON PENTACARBONYL AND LEAD TETRAETHYL M.S. Thesis. Final Report, 1 May 1971 - 31 Mar. 1973
Marcel Vanpee and Michael Yaron 2 Apr. 1973 52 p refs
(Contract F19628-71-C-0130; AF Proj. 7635)
(AD-762317; AFCRL-TR-73-0169) Avail: NTIS CSCL 07/4

The relative and absolute intensities of trimethylaluminum (TMA), iron pentacarbonyl, lead tetraethyl, and nitrogen oxide upon reaction with atomic oxygen were studied experimentally. The results have shown that the TMA and oxygen reaction created the strongest intensity, followed by NO, Fe(CO)5, and Pb(C2H5)4. An attempt was made to produce fluorescence by shining light through the clouds formed by the individual reactions in order to identify the various oxide bands. However, the results were inconclusive. Author (GRA)

N73-28008# Naval Underwater Systems Center, Newport, R.I. Weapons Dept.
FRICTION REDUCTION IN DILUTE SOLUTIONS OF POLYSTYRENE, PART 1
Richard H. Nadolink 18 May 1973 50 p refs
(NUSC Proj. A-358-03; ONR Proj. PO-2-0220)
(AD-761600; NUSC-TR-4422-Pt-1) Avail: NTIS CSCL 07/4

Experiments reported herein were carried out to define and produce a calibrated polymer candidate which exhibited friction reduction with simultaneous specification of its macro-molecular properties. A series of polystyrene polymers were synthesized by a novel polymerization scheme and were extensively characterized by modern and classical techniques. The results of turbulent flow and shear wear experiments on these polystyrenes defined a range of molecular parameters in which excellent dilute solution performance was obtained for the first time reported. A complete analytical specification of the weight distribution function

was obtained from experimental data. Intrinsic viscosity and normal stress measurements were made and interpreted. The acquisition of these uniquely characterized polysytrenes is shown to form a basis for future studies. Recommendations are made as to direction and execution of future research into polystyrene and other polymer mechanisms which are aimed at optimizing performance in naval applications. (Modified Author Abstract) GRA

N73-28009# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF MOLECULAR WEIGHT FROM EQUILIBRIUM SEDIMENTATION. PART 7: MATHEMATICAL ANALYSIS OF THE REGULARIZATION TECHNIQUE INCORPORATED INTO QUADRATIC PROGRAMMING
Summary Technical Report, Sep. 1971 - May 1972
Donald R. Wiff, Matatiahu T. Gehatia, and Thomas E. Duvall Dec. 1972 66 p refs
(AF Proj. 7342)
(AD-761818; AFML-TR-67-121-Pt-7) Avail: NTIS CSCL 07/4

The equation relating molecular weight distribution of a polymer to the experimental function of concentration appearing in equilibrium sedimentation with the ultracentrifuge is nonsolvable because it is an improperly posed problem in the Hadamard sense. For a simple distribution this equation has been solved by applying a method of regularization. To solve a nonsymmetrical bimodal and a trimodal distribution, the technique of regularization had to be incorporated into a linear programming. In the current work the regularization technique has been incorporated into quadratic programming. This new combined method proved to be more adequate to solve also more complex distributions such as tri-, tetra-, and pentamodal. In addition, this technique is cheaper, because it requires less computer time than the regularization incorporated into linear programming.
Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N73-28010 British Broadcasting Corp., Kingswood (England). Research Dept.
IONOSPHERIC NON-LINEARITY: PROTECTION RATIOS REQUIRED AGAINST CROSS-MODULATION INTERFERENCE (LUXEMBOURG EFFECT)
D. J. Whythe and C. R. G. Reed Jun. 1973 7 p refs
(BBC-RD-1973/5; EL-76) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Studies of intermodulation of a weak signal by a strong signal in the ionosphere have defined the degree to which the level of intermodulation varies as a function of modulation frequency of the strong signal. Experiments which show that, as a result, a 6 db relaxation, relative to co-channel interference, may be allowed in the permissible level of crossmodulation interference, measured at a modulation frequency of 300 Hz. are described. Author

N73-28011 British Broadcasting Corp., Kingswood (England). Research Dept.
DIGITAL VIDEO: DIFFERENTIAL CODING OF PAL SIGNALS BASED ON DIFFERENCES BETWEEN SAMPLES ONE SUBCARRIER PERIOD APART
V. G. Devereux Jun. 1973 16 p refs
(BBC-RD-1973/7; EL-78) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Methods for reducing the bit-rate required for digital coding of System I (PAL 625-line) video signals by means of differential pulse code modulation are discussed. The subjective effect of various d.p.c.m. and hybrid d.p.c.m./p.c.m. coding systems were investigated with a view to finding a system giving broadcast quality pictures. All the systems examined would require the transmission of either five or six bits per sample at a sampling frequency which is thrice the PAL color subcarrier frequency. The d.p.c.m. codes used in most experiments indicate the change in level between every third sample of the video signal, but the possibility of conditional operation using adjacent samples was also examined. The results of subjective tests indicated that for a single coding and decoding operation, broadcast quality pictures can be obtained using five bits per sample. In practice, however, up to two extra bits would probably be required per sample to allow for several coders and decoders in tandem and for error protection. Author

N73-28012* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RECEIVER WITH AN IMPROVED PHASE LOCK LOOP IN A MULTICHANNEL TELEMETRY SYSTEM WITH SUPPRESSED CARRIER Patent
Stanley Butman and Uzi Timor, inventors (to NASA) Issued 10 Jul. 1973 6 p Filed 18 Aug. 1971 Supersedes N72-20162 (10 - 11, p 1440) Sponsored by NASA
(NASA-Case-NPO-11593-1; US-Patent-3,745,255; US-Patent-Appl-SN-172807; US-Patent-Class-179-15FS; US-Patent-Class-329-122; US-Patent-Class-325-419) Avail: US Patent Office CSCL 09F

A phase lock loop is described for a receiver in a two-channel PSK/PM telemetry system with a suppressed carrier. The receiver inphase channel output is filtered by first and second bandpass filters and the receiver quadrature channel output is filtered by first and second bandpass filters and the receiver quadrature channel output is filtered by third and fourth bandpass filters. The first and third filters have the same bandwidth, centered about the frequency of one subcarrier and is wide enough to pass data around the first harmonic of the subcarrier. The second and fourth bandpass filters have the same bandwidth centered about the frequency of the other subcarrier and is wide enough to pass data around the first harmonic of this subcarrier. The outputs of the first and third filters are mixed in one mixer and the outputs of the second and fourth filters are mixed in another mixer. The outputs of the two mixers are weighted to produce a weighted sum signal which is supplied to the loop filter.
Official Gazette of the U.S. Patent Office

N73-28013* Philco-Ford Corp., Palo Alto, Calif.
COMPOSITE ANTENNA FEED Patent
Vito Joseph Jakstys, inventor (to NASA) Issued 17 Jul. 1973 7 p Filed 21 Sep. 1971 Supersedes N72-20155 (10 - 11, p 1439) Sponsored by NASA
(NASA-Case-GSC-11046-1; US-Patent-3,747,111; US-Patent-Appl-SN-182399; US-Patent-Class-343-725; US-Patent-Class-343-729; US-Patent-Class-343-797; US-Patent-Class-343-803; US-Patent-Class-343-893) Avail: US Patent Office CSCL 17B

A composite antenna feed subsystem concentrated in a small area at the prime focus of the parabola of a satellite parabolic reflector accomodates a plurality of frequency bands. The arrays comprising the subsystem are mounted on the top cover of a communication module. A multimode horn is arranged at the center of the subsystem axis which functions at X- And C-band frequencies, and a cross array consisting of individual elements form the S-band feed, with one arm of the S-band array containing an element mutually shared with the L-band array. Provision is also made for UHF frequencies, and a dipole arrangement for VHF frequencies is arranged around the S-band arms.
Official Gazette of the U.S. Patent Office

N73-28014 Alabama Univ., University.
POLARIZATION FLUCTUATION OF A FINITE BEAM WAVE PROPAGATION IN THE ATMOSPHERE Ph.D. Thesis
Feng-cheng Chang 1972 113 p
Avail: Univ. Microfilms Order No. 73-8028

The spatial and time correlation functions of the depolarization angle fluctuation, as well as the log-amplitude and phase fluctuations are obtained for a finite beam wave propagation in a random atmosphere using the Tatarski model of turbulence and taking into account transverse wind velocity. The beam wave is transmitted from an extended source with a circularly symmetric Gaussian amplitude distribution and a curved wave-front which characterize the beam shape. The dependence of the depolarization

angle fluctuation upon the wavelength, the beam shape, and the scale of turbulence is discussed in detail for various situations. Dissert. Abstr.

N73-28015 Princeton Univ., N.J.
MAXIMIN SONAR DESIGN Ph.D. Thesis
John Sevier Farnbach 1972 183 p
Avail: Univ. Microfilms Order No. 73-9606

The design of signals and linear envelope detectors to maximize signal to noise ratio is considered in the context of SONAR, detection. The reverberation is modeled by a simple first order scattering process, and the total noise is taken as the sum of reverberation and an independent white noise. Dissert. Abstr.

N73-28016 Princeton Univ., N.J.
DETECTION OF SIGNALS IN NON-GAUSSIAN NOISE Ph.D. Thesis
James Harold Miller 1972 248 p
Avail: Univ. Microfilms Order No. 73-9630

A class of detectors for signals in additive noise that is not generally Gaussian is considered. Attention is confined to the discrete-time case and it is assumed that the received samples are statistically independent. These two assumptions give a relatively simple detector structure consisting of a zero memory nonlinearity followed by a linear filter whose output is then compared to some threshold. Dissert. Abstr.

N73-28017 New York Univ., N.Y.
OPTIMIZATION AND EVALUATION OF SEVERAL DIGITAL COMMUNICATION SYSTEMS DISTURBED BY NON-GAUSSIAN NOISE Ph.D. Thesis
Daniel Sheinbein 1972 208 p
Avail: Univ. Microfilms Order No. 73-9085

Several digital communication systems disturbed by noise represented by a combination of Gaussian and impulsive noise are analyzed. A suboptimum detector which consists of a limiter followed by a linear filter is hypothesized and analyzed. The optimum filter is derived and compared to the detector with an integrator. The form of the filter solution depends on the type and value of the constraints on the filter. A representation theory using a generalized Fourier series approximation is developed where an exponential form is assumed for both the unknown and reference p.d.f.. Based on the new representation a model for the mixture p.d.f. and the likelihood ratio is formulated. The likelihood ratio based on the mixture p.d.f. is found to have a smaller probability of error than one based on the Gaussian p.d.f.. Also developed is a two dimensional representation theory. Dissert. Abstr.

N73-28018# Signals Research and Development Establishment, Christchurch (England).
THE MI PROBLEM OF CO-SITED RADIO SETS WITH REFERENCE TO THEIR PERFORMANCE AS A FUNCTION OF TOTAL LINK SELECTIVITY
M. J. Walker Jul. 1972 31 p
(SRDE-72023; BR31146) Avail: NTIS HC $3.75 CSCL 17B

The mutual interference problem of co-located radio sets with reference to their performance as a function of total link selectivity is discussed. It is shown that be ordering the sequence and scope of decisions, it is possible to divide the front end selectivity in a radio set in an optimum manner between transmitter and receiver to achieve a desired mutual interference specification. An example is provided and repeated with various parameter changes to illustrate the technique. Author

N73-28019# Institute for Telecommunication Sciences, Boulder, Colo.
A REVIEW OF PROPAGATION FACTORS IN TELECOMMUNICATIONS APPLICATIONS OF THE 10 TO 100-GHZ RADIO SPECTRUM
M. C. Thompson, Jr., L. E. Vogler, H. B. Janes, and L. E. Wood Aug. 1972 81 p refs
(OT/TRER-34) Avail: SOD $0.75

Systems applications in the 10- to 100-GHz frequency band, propagation factors pertinent to the design of these systems, and recommendations for future action are discussed. Consideration is given to the complementary roles of experiment and analysis in providing the information necessary for optimum utilization of EHF frequencies. Author

N73-28020*# TRW Systems Group, Redondo Beach, Calif.
PREFLIGHT SL-1/SL-3 SKYLAB VHF RANGING COVERAGE (NOMINAL TPI). ANTENNA AND PROPAGATION STUDIES FOR SPACECRAFT SYSTEMS, TASK E-531
D. R. Eisenhauer and D. A. James 13 Jul. 1973 47 p refs (Contract NAS9-12330)
(NASA-CR-133981; TRW-20029-H203-R0-00) Avail: NTIS HC $4.50 CSCL 17B

A preflight assessment of the Skylab VHF ranging coverage for the rendezvous portion of the nominal SL-1/SL-3 mission is reported, assuming a 27 July 1973 SL-3 launch. Data are based on a nominal attitude trajectory, which has the Saturn workshop in a solar inertial attitude throughout the rendezvous; the CSM terminal phase initiation maneuver is nominal. An addendum to this report is being prepared, which considers the effects of early and late TPI maneuvers. Curves are presented which show the variation in received power levels on both spacecraft-to-spacecraft links from about 600 n.mi. range to CSM and SWS station keeping. Appropriate threshold levels are shown on these received power curves to indicate zero circuit margins for the ranging function. Author

N73-28021# Joint Publications Research Service, Arlington, Va.
LOMO VK-1/2 TYPE SMALL VIDEO TAPE RECORDER
M. G. Shulman, V. A. Kostin, Ye. N. Nikonov, and M. P. Baronin 25 Jul. 1973 15 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (Moscow), no. 1, 1972 p 38-45
(JPRS-59611) Avail: NTIS HC $3.00

A description of the LOMO VK-1/2 type video tape recorder is presented. Author

N73-28022# Joint Publications Research Service, Arlington, Va.
TECHNICAL FACILITIES OF THE SIRENA-1 DATA LINK SYSTEM
V. N. Silayev, O. K. Bazilenko, V. L. Bakhrakh, Yu. F. Bubennov, V. Ye. Khazatskiy, A. S. Ipatov, Yu. N. Muravitskiy, and V. P. Popov 31 Jul. 1973 12 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 4, Apr. 1973 p 1-4
(JPRS-59662) Avail: NTIS HC $3.00

The means of concentrating data flows, methods of ensuring reliable data transmission, and direct multichannel connection in the Sirena-1 data link system are discussed. Author

N73-28023*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TRANSMITTER AND RECEIVER ANTENNA GAIN ANALYSIS FOR LASER RADAR AND COMMUNICATION SYSTEMS
Bernard J. Klein and John J. Degnan Jun. 1973 67 p refs Submitted for publication
(NASA-TM-X-70423; X-524-73-185) Avail: NTIS HC $5.50 CSCL 17B

A comprehensive and fairly self-contained study of centrally obscured optical transmitting and receiving antennas is presented and is intended for use by the laser radar and communication systems designer. The material is presented in a format which allows the rapid and accurate evaluation of antenna gain. The Fresnel approximation to scalar wave theory is reviewed and the antenna analysis proceeds in terms of the power gain. Conventional range equations may then be used to calculate the power budget. The transmitter calculations, resulting in near and far field antenna gain patterns, assumes the antenna is illuminated by a laser operating in the fundamental cavity mode. A simple equation is derived for matching the incident source distribution to a general antenna configuration for maximum on-axis gain. An interpretation of the resultant gain curves allows a number of auxiliary design curves to be drawn which display the losses in antenna gain due to pointing errors and the cone angle of the outgoing beam as a function of antenna size and central obscuration. The use of telescope defocusing as an approach to spreading the beam for target acquisition is compared to some alternate methods. Author

N73-28024# Siemens A.G., Munich (West Germany). Bereich Weitverkehrstechnik.
A 1 GHz LINEAR PHASE FILTER FOR SATELLITE USE Final Report
G. A. Pfitzenmaier Oct. 1972 87 p refs
(Contract ESTEC-1653/72-SL)
(ESRO-CR(P)-253) Avail: NTIS HC $6.50

A 1 GHz linear phase filter was constructed for application to a communication satellite. The central frequency (at 20 C) is 820 MHz, and the usable bandwidth is 18 MHz. To simplify calculations, not the bandpass filter itself is designed, but a reference lowpass filter. Association is possible by using a reactance transformation. To achieve a Q of 3000, 14 parallel resonators of the bandpass filter were provided in the form of TEM resonators with a square outer conductor, and a round inner conductor. Two temperature compensated breadboard models with the midband frequency of 820 MHz were assembled and tested. ESRO

N73-28025# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
STUDY OF WIDEBAND UHF FERRITE DEVICES [ETUDE DE DISPOSITIFS UHF A FERRITE A TRES LARGE BANDE]
Blanc, Guidevaux, and Dusson [1972] 5 p In FRENCH
(Contract DRME-69/34-539-00-480-75-01)
Avail: NTIS HC $3.00

The insertion of circulators and isolators into a microstrip was investigated. A 180 deg cell for digital phase shifter working in the KU (16 to 16 gHz) band was realized. The feasibility of wideband circulators and isolators was analyzed studying the wave surfaces, the ternary junctions, and the marginal modes. It was concluded that the characteristics of the KU phase shifter are similar to those of phase shifters working in C and X band. ESRO

N73-28026# Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
SYNTHESIS AND LOW AND HIGH LEVEL UHF PROPERTIES OF HOT PRESSED MANGANESE/MAGNESIUM FERRITES OF THE SPINEL TYPE FOR X BAND APPLICATIONS [ETUDE DE LA SYNTHESE ET DES PROPRIETES EN BAS ET HAUT NIVEAU UHF D'UN FERROSPINELLE DE MANGANESE ET MAGNESIUM PRESSE A CHAUD, UTILISABLE EN BANDE X]
J. Nicolas, R. Sroussi, and A. Hermosin [1972] 5 p In FRENCH
(Contract DRME-69/34-539-00-480-75-01)
Avail: NTIS HC $3.00

New ferrites of spinel type and polycrystalline garnets to be used at ultrahigh frequencies were developed using the high pressure sintering technique. These materials were used in the manufacturing of high performance microstrip circulator models working the X and C band range. The viscosity coefficient and the activation energy corresponding to two densification processes observed at the initial and final stages of the sintering were calculated. ESRO

N73-28027# Texas Instruments, Inc., Dallas.
MODULATION WAVEFORM STUDY Final Report, 19 Nov. 1971 - 29 Aug. 1972
Richard Ridings, Charles R. Reeves, and Jon P. Aasterud Griffiss AFB, N. Y. RADC Mar. 1973 334 p refs
(Contract F30602-72-C-0102)
(AD-761522; RADC-TR-73-77) Avail: NTIS CSCL 17/2

The Modulation Waveform Study is addressed to the determination of the optimum spread-spectrum modulation technique for use in a ground sensor-to-airborne relay communications link. The study is conducted under a set of guidelines concerning digital message error rates, message structure, communication link distance, frequency, multiple access capability (i.e., self-interference) and processing gain against intentional jamming. Pseudonoise, time hop, frequency hop, and hybrid modulation techniques are examined and only two are found to be suitable for satisfying the study guideline: frequency hop and time hop/pseudonoise. Author (GRA)

N73-28028# Naval Postgraduate School, Monterey, Calif.
COMPUTERIZED MANAGEMENT TOOLS FOR USE IN THE ANALYSIS OF AUTODIN AUTOMATIC SWITCHING CENTERS AND ASSOCIATED TRIBUTARIES M.S. Thesis
Robert Bruce McManis Mar. 1973 87 p refs
(AD-761479) Avail: NTIS CSCL 17/2

A general AUTODIN and Automatic Switching Center (ASC) system description is presented to orient the reader. A GPSS model of the Communications Data Processor (CDP) at the ASC was constructed, as a first step toward constructing an overall ASC simulation model. The capabilities and limitations of the simulation are discussed. Several experiments were conducted to ascertain the effects on the CDP message congestion and transit time of varying the volume of traffic passing through the system and the number of tributaries capable of receiving traffic. A COBOL program, which calculates queuing information for the ASC tributaries, is described. The results of the program output are interpreted and uses of the information produced are discussed. Conclusions are drawn concerning the performance of the AUTODIN ASC as shown by the simulation and program. Anticipated project applications are described. Author (GRA)

N73-28029# Duke Univ., Durham, N.C. Adaptive Signal Detection Lab.
PERFORMANCE COMPARISON OF A SUB-OPTIMAL ARRAY PROCESSOR M.S. Thesis. Summary Technical Report, 1971 - 1972
William Searles Hodgkiss, Jr. Dec. 1972 94 p refs
(Contract N00014-70-A-0251-0001)
(AD-762048; TR-8) Avail: NTIS CSCL 09/4

The purpose of the research is to compare the performance of two detection receivers for the signal known except for direction (SKED) array problem. Each receiver represents a different approach to the problem's solution--one is designed under the Bayesian philosophy (parametric) and the other uses a classical beam sweeping approach. These are noted as the optimal and sub-optimal detectors, respectively. It is shown that both processors can be implemented as estimate and plug structures using the conditional likelihood ratio. The two estimators used are the pseudo estimate (X(PSE)) and maximum likelihood estimate (X(MLE)). An in depth discussion of these two estimators reveals that X(PSE) is simply equal to X(MLE) plus a data dependent correction term. A performance comparison is made for the two and three element array cases. It is shown that the sub-optimal detector performs the same as the optimal detector when A sub zero = zero (uniform a priori knowledge). Furthermore, for a two element array, the results are proven analytically. Author (GRA)

N73-28030# Raytheon Co., Wayland, Mass. Equipment Development Labs.
HYBRID DIGITAL ANALOG TROPO SYSTEM Final Report, Jun. 1971 - Jan. 1973
Manfred G. Unkauf Apr. 1973 129 p refs
(Contract F30602-71-C-0375)
(AD-761523; RADC-TR-73-99) Avail: NTIS CSCL 17/2

A new technique is described which permits the hybrid addition of both digital TDM data and analog FDM/FM traffic on a single carrier simultaneously. The analog FDM/FM carrier is directly Phase Shift Keyed (PSK) modulated by the digital data to form the hybrid signal and a novel, decision feedback demodulator is described which separates and demodulates the two signal components. A mathematical model is derived based on FM noise theory and the transient response characteristics of the demodulator. This model is used to describe the theory of operation of the modulation technique and also to provide back-to-back and over-the-air performance estimates. Performance estimates are provided for non, dual, and quad diversity, various loading parameters of FDM/FM systems for various system configurations, including 64 Kbps digital rate together with 24 to 600 analog voice channels. A model for the variability of over-the-air multipath delay spread is also derived and used to predict the time availability of various grades of service. The design and construction of an experimental model of the hybrid modulation technique is described. Both back-to-back and over-the-air test programs and test results are described. The experimental results are compared to the theoretical prediction

for various system configurations with good agreement.
Author (GRA)

N73-28031# Army Foreign Science and Technology Center, Charlottesville, Va.
THE SNAR-1 RADAR (TECHNICAL CHARACTERISTICS), PART 1, BOOK 2
4 Jan. 1973 163 p Transl. into ENGLISH from unidentified Russian article
(AD-761534; FSTC-HT-23-156-68-Pt-1-Bk-2) Avail: NTIS CSCL 17/9

The report includes information on the indicator panel, the tracking panel, the oscillation tracer or the oscilloscope, the feeding (or input) sources for the set, communication devices, the vehicle and set cabin, and the Zeis 151 truck and the power unit. (Modified Author Abstract) GRA

N73-28032# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A RECOGNITION ALGORITHM FOR LIQUIDS AND GLIDES
Ronald Newman and Su May Chou May 1973 13 p refs
(Grant AF-AFOSR-1776-69; AF Proj. 9769)
(AD-762377; TR-EE73-21;. AFOSR-73-1042TR) Avail: NTIS CSCL 17/2

A study was made on liquids and glides /l,r,w,y/ with the objective of discrimination among them in an automatic recognition system. Spectral time samples were selected from digital spectrograms of isolated bisyllabic utterances spoken by two male and two female talkers. Frequency dimensionality reduction was achieved using dispersion analysis. The sequences of reduced time sample were subsequently time smoothed and transformed to string representations using a chain-encoding technique. Based on the set of strings for each phoneme, syntactic recognition algorithms were applied. Recognition results for the four talkers are presented and discussed. Author (GRA)

N73-28033# Naval Underwater Systems Center, Newport, R.I.
ELECTROMAGNETIC COMPATIBILITY AND INTERFERENCE CONTROL PLAN REQUIREMENTS
John W. Merrick and Ronald H. Herget 1 May 1973 24 p refs
(AD-761975; NUSC TD-4573) Avail: NTIS CSCL 20N

An Electromagnetic Compatibility and Interference (EMC/1) Control Plan is the controlling element and guiding document for an effective Electromagnetic Compatibility Program. The document describes the contractual requirements necessary for the submission of an EMC/1 Control Plan, describes the program manager's technical responsibility during use of the EMC/1 Control Plan, and gives an expanded outline for the contents of an EMC/1 Control Plan for a developmental program.
Author (GRA)

N73-28034# Naval Electronics Lab. Center, San Diego, Calif.
CALCULATED NEAR FIELDS OF NAVY HF WHIP ANTENNAS Research and Development Report, Jul. 1972 - Feb. 1973
J. W. Rookway and P. M. Hansen 24 Apr. 1973 32 p refs
(AD-761979; NELC-TR-1872) Avail: NTIS CSCL 09/5

The hazards to personnel, ordnance, and fuel caused by shipboard hf radiators are determined. Numerical techniques are used to calculate the peak field intensities produced by 1-kW power input to standard Navy whip antennas in configurations similar to shipboard geometries. Preliminary guidelines are established indicating the size of the hazardous region surrounding the antenna for both ordnance and personnel. Author (GRA)

N73-28035*# Hawaii Univ., Honolulu.
PACKAGE SWITCHING WITH SATELLITES
Norman Abramson Mar. 1973 29 p refs Presented at 1973 Natl. Computer Conf. and Exposition, New York, 4-8 Jun. 1973 Sponsored in part by ARPA Prepared in cooperation with Systems Res. Corp., Honolulu
(Contracts NAS2-6700; F44620-69-C-0030; N00014-70-C-0414; AF Proj. 9558)
(AD-761544; B73-2; NASA-CR-133530; AFOSR-73-0984TR) Avail: NTIS HC $3.50 CSCL 17/2

The beginning of the 1970's has witnessed the establishment of new forms of computer-communication networks, with clear advantages over the voice oriented point-to-point, channel switched networks of the 1960's. The paper describes some of the most important properties of these new networks -- packet switching, bilateral broadcasting and burst random access capabilities. The advent of easily available, inexpensive satellite communications gives added importance to these properties and promises added capabilities for computer-communication networks of the future. The paper provides a theoretical framework from which can be derived the capacity, delay and average power of these new forms of communication. Finally it describes how these forms of communication might be employed in some of the planned US domestic satellite systems to provide a public packet switched service. Author (GRA)

N73-28036# Haskins Labs., Inc., New York.
SPEECH RESEARCH: A REPORT ON THE STATUS AND PROGRESS OF STUDIES ON THE NATURE OF SPEECH, INSTRUMENTATION FOR ITS INVESTIGATION, AND PRACTICAL APPLICATION Status Report, 1 Jan. - 31 Mar. 1973
Franklin S. Cooper May 1973 272 p refs
(Contracts N00014-67-A-0129-0001; V101(134)P-71; HD-71-2420; Grants NSF GS-28354; DE-01774; HD-01994; RR-5596)
(AD-762373; SR-33-1973) Avail: NTIS CSCL 17/2

Progress is reported on 21 topics relating to speech, including physiological mechanisms, vowels and consonants, perception and misperception, electromyography, reading, language, cues, intelligibility, retention, linguistics, articulation, and allied subjects. GRA

N73-28037# Utah Univ., Salt Lake City. Computer Science Div.
A PRIORI DIGITAL SPEECH ANALYSIS
Steven Frank Boll Mar. 1973 118 p refs Sponsored in part by ARPA
(Contract F30602-70-C-0300)
(AD-762029; UTEC-CSC-73-123) Avail: NTIS CSCL 17/2

The paper describes a priori digital speech analysis. This method takes advantage of the quasi-periodic nature of voiced speech sounds to reduce the amount of computation needed to obtain the analysis parameters. The paper is divided into five main areas: A digital model of the human speech apparatus and its analysis by linear predictive coding is described. The specific details of an analysis-synthesis system which was developed to test the a priori method are presented. The description of how the predictor coefficients can be estimated using a priori least square is given. Pitch detection using a priori methods is described and compared with two other popular methods. The methods of classical, a priori, and recursive least-squares estimation are developed, both from an algebraic and geometric viewpoint. (Modified Author Abstract) GRA

N73-28038# Ohio State Univ., Columbus. Electroscience Lab.
MEMORANDUM ON THE RADIATION PATTERNS OF A SLOT ASYMMETRICALLY LOCATED ON A SQUARE PLATE
C. Donn and G. A. Thiele Jun. 1973 36 p refs
(Contract N00014-67-A-0232-0018)
(AD-762056; ESL-2142-12) Avail: NTIS CSCL 09/5

A slot antenna mounted symmetrically in the center of a square plate will radiate a symmetrical antenna pattern. When the slot is moved to any other location the pattern will be unsymmetrical. The degree of symmetry degradation for various locations of a slot on a 2 by 2 square plate at approximately 1 GHz and 3 GHz is the subject of this investigation. To make the pattern calculations well-known first-order principles of the geometrical theory of diffraction (GTD) are used. A user oriented computer program is presented in the appendix and its limitations discussed. Author (GRA)

N73-28039# Alabama Univ., Huntsville.
THEORY AND IMPLEMENTATION OF FAST FOURIER AND HADAMARD TRANSFORMS, VOLUME 1 Interim Technical Report, Mar. 1972 - Mar. 1973
Robert J. Polge, B. K. Bhagavan, James W. Carswell, and Edward R. Mckee, Jr. Apr. 1973 144 p refs

(Contract DAHC60-72-C-0071)
(AD-762437; UAH-RR-143) Avail: NTIS CSCL 17/9

A general algorithm is developed for the east fourier transform and Hadamard transform from which optimum computer program can be written as a signal analysis tool. The need for such discrete transforms is obvious from the introductory treatment of integral transforms, fourier series, and the sampling theorem. First, the radix-2 algorithm is treated in detail for N = 8 and then extended to N = 2 to the M power. A general transformation algorithm is derived next to accommodate arbitrary factors. This very useful general algorithm is also used to implement and optimize various FFT algorithms. A general unscrambling formula is derived to optimize the unscrambling process for radix-2 and radix-4 algorithms. Techniques are given but not yet optimized for unscrambling with respect to odd factors. All FFT programs discussed are evaluated in terms of number of operations and computer time. The Hadamard transform is defined and computer programs developed. Finally, the properties of the FFT and the Hadamard transform are discussed in light of their application to radar processing. Author (GRA)

N73-28040# Alabama Univ., Huntsville. Interim Technical Report, Mar. 1972 - Mar. 1973
SIGNAL PROCESSING TECHNIQUES FOR REAL-TIME RADAR APPLICATIONS, VOLUME 2
Robert J. Polge, Louis Callas, B. K. Bhagavan, and Arun Sinh Apr. 1973 142 p refs
(Contract DAHC60-72-C-0071)
(AD-762438; UAH-RR-144) Avail: NTIS CSCL 17I

The purpose of the report is to compare various combinations of signal modulations and digital processing techniques and to evaluate them in terms of performance versus computer time. Several mathematical techniques for representation of discrete convolution of narrow band high frequency signals are presented, including a new technique called piecewise polynomial convolution. Applications of efficient FFT and Hadamard transform programs to digital radar signal processing are discussed. Problems of radar detection are analyzed including the complex representation of the radar signal, definition of ambiguity function, performance criteria, and matched filter. (Modified Author Abstract) GRA

N73-28041# Alabama Univ., Huntsville.
RADAR/DATA PROCESSOR INTERFACE STUDIES, VOLUME 3 Interim Technical Report, Mar. 1972 - Mar. 1973
Roy D. Hays and Robert J. Polge Apr. 1973 51 p refs
(Contract DAHC60-72-C-0071)
(AD-762439; UAH-RR-145) Avail: NTIS CSCL 17/9

The report is a documentation of work performed in support of ABMDA in the definition, evaluation, and selection of the radar/data processor interface between the Advanced Field Array Radar (AFAR) and a fourth generation vector computer (Texas Instruments/Advanced Scientific Computer). It discusses the interface design considerations, and contains a suggested interface functional allocation between the radar and computer. Microprogramming is described as a means of implementing the interface while maintaining the desired modularity and flexibility. Author (GRA)

N73-28042# Radiation, Inc., Melbourne, Fla.
WIDEBAND COMMAND AND CONTROL MODEM Final Technical Report, 14 Jun. - 14 Dec. 1972
Albert R. Martin, Jay D. Knoner, and Raymond F. Cobb Griffiss AFB, Ohio RADC Dec. 1972 271 p
(Contract F30602-72-C-0498; ARPA Order 2154)
(AD-762281; RADC-TR-73-91) Avail: NTIS CSCL 17/2

The report contains the tradeoffs and resultant baseline design for a Wideband Command and Control Modem. The waveform design for this modem provides uplink command data from a master ground station to each of 25 vehicles and receives status data in return. In addition, wideband imagery information is received from up to five of the vehicles in the target area. The application of this modem to remote pilotless vehicle (RPV) missions requires jam-resistant communications, especially for the command uplink, and requires a modem design with extremely low recurring costs for the vehicle electronics. (Modified Author Abstract) GRA

N73-28043# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
REFINEMENT AND VERIFICATION OF THE AN/MPS-36 RADAR COMPUTER SIMULATION PROGRAM Final Report
W. H. Beckett, D. J. Dempsey, R. D. Mitchell, and D. C. Drumheller Jun. 1973 137 p
(Contract DAAD07-72-C-0169)
(AD-762338) Avail: NTIS CSCL 17/9

The final report provides a comparison between actual and simulated radar tracking and test data. The AN/MPS-36 Mobile Instrumentation Radar is the subject of these tests and data comparisons are presented which verify that a previously developed computer simulation of this radar does satisfactorily simulate the operation and performance of the actual radar. Author (GRA)

N73-28818* Los Alamos Scientific Lab., N.Mex.
THE POSITION AND SIZE OF RADIO SOURCES ASSOCIATED WITH SOLAR ELECTRON EVENTS
I. D. Palmer and R. P. Lin (Calif. Univ., Berkeley) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 594-601 refs Sponsored in part by AEC (For availability see N73-28772 19-29)
(Grant NGL-05-003-017)
CSCL 20N

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N73-28044 British Broadcasting Corp., Kingswood (England). Research Dept.
EQUIPMENT FOR THE TRANSFER OF DIGITAL VIDEO SIGNALS TO PAPER TAPE
C. K. P. Clarke Jun. 1973 7 p ref
(BBC-RD-1973/6; PH-108) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Equipment is reported for transferring monochrome pulse code modulation television signals derived from a slide scanner to punched paper tape. One eight-bit word is extracted from the repeated signal during each picture period and is then punched as a single eight-element character on the tape. The equipment has been used to produce two paper tapes each containing an area of picture 256 picture elements wide and 256 lines high. The report includes a picture reconstituted from one of the tapes. Author

N73-28045* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ANALOG-TO-DIGITAL CONVERTER Patent
Lanny L. Lewyn, inventor (to NASA) Issued 23 Nov. 1965 6 p Filed 26 Feb. 1962 Sponsored by NASA
(NASA-Case-XNP-00477; US-Patent-3,219,997; US-Patent-Appl-SN-175497; US-Patent-Class-340-347) Avail: US Patent Office CSCL 09B

An analog to digital converter circuit arrangement is reported that is suitable for use in ultra fast pulse height analysis. The circuit uses series connected tunnel diodes to quantize a voltage signal into discrete levels. G.G.

N73-28046 Illinois Univ., Urbana.
RASER: RANDOM TO SERIAL CONVERTER
Takehiko Ketoh 1972 56 p
Avail: Univ. Microfilms Order No. 73-9966

Raser is an on-line binary scan converter, designed to convert pictorial information from the computer output form (RAndom) to a raster format (SERial) suitable for a TV display. Raster also performs picture rotation, shrinking or expansion along with the scan conversion. In RASER a 16 x 4k bit core memory is used as a (binary) video memory. Both input and output of the binary video memory are points (x,y) in a plane. For normal scan conversion, picture rotation and shrinking (with scan conversion), the 4 least significant bits of the x coordinate determine the bit

location of the (x,y) pair and the 4 most significant bits of x coordinate, along with the 8 bits of y coordinate, the address of the (x,y) pair. Therefore, no calculations are required in order to determine the appropriate word and bit locations from the (x,y) coordinates. Dissert. Abstr.

N73-28047*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
AN UPDATE OF INPUT INSTRUCTIONS TO TEMOD
18 Jun. 1973 92 p ref
(NASA Order C-21029-C; Contract AT(04-3)-701)
(NASA-CR-121225; WANL-TME-1906A) Avail: NTIS HC $6.75 CSCL 09B

The theory and operation of a FORTRAN 4 computer code, designated as TEMOD, used to calcuate tubular thermoelectric generator performance is described in WANL-TME-1906. The original version of TEMOD was developed in 1969. A description is given of additions to the mathematical model and an update of the input instructions to the code. Although the basic mathematical model described in WANL-TME-1906 has remained unchanged, a substantial number of input/output options were added to allow completion of module performance parametrics as required in support of the compact thermoelectric converter system technology program. Author

N73-28048*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
STUDY OF A HYBRID MULTISPECTRAL PROCESSOR
R. E. Marshall and F. J. Kriegler Jul. 1973 68 p refs
(Contract NAS9-9784)
(NASA-CR-133976; ERIM-31650-154-T) Avail: NTIS HC $5.50 CSCL 09B

A hybrid processor is described offering enough handling capacity and speed to process efficiently the large quantities of multispectral data that can be gathered by scanner systems such as MSDS, SKYLAB, ERTS, and ERIM M-7. Combinations of general-purpose and special-purpose hybrid computers were examined to include both analog and digital types as well as all-digital configurations. The current trend toward lower costs for medium-scale digital circuitry suggests that the all-digital approach may offer the better solution within the time frame of the next few years. The study recommends and defines such a hybrid digital computing system in which both special-purpose and general-purpose digital computers would be employed. The tasks of recognizing surface objects would be performed in a parallel, pipeline digital system while the tasks of control and monitoring would be handled by a medium-scale minicomputer system. A program to design and construct a small, prototype, all-digital system has been started. Author

N73-28049*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ON-BOARD PROCESSING FOR DATA COLLECTION SATELLITE SYSTEMS Final Report
George R. Cooper and Frank Fellinger 18 Feb. 1972 38 p
(Grant NGR-15-005-143)
(NASA-CR-132792) Avail: NTIS HC $4.00 CSCL 09D

The research and results for the specific tasks of this program are summarized. The proposed tasks and status discussed include: Coarse frequency measurement, fine frequency measurement, message format design, data reduction, and system error analysis. F.O.S.

N73-28050*# Cramer (H.E.) Co., Inc., Salt Lake City, Utah.
NASA/MSFC MULTILAYER DIFFUSION MODELS AND COMPUTER PROGRAM FOR OPERATIONAL PREDICTION OF TOXIC FUEL HAZARDS
R. K. Dumbauld, J. R. Bjorklund, and J. F. Bowers Jun. 1973 293 p refs
(Contract NAS8-29033)
(NASA-CR-129006) Avail: NTIS HC $16.75 CSCL 09B

The NASA/MSFC multilayer diffusion models are discribed which are used in applying meteorological information to the estimation of toxic fuel hazards resulting from the launch of rocket vehicle and from accidental cold spills and leaks of toxic fuels. Background information, definitions of terms, description of the multilayer concept are presented along with formulas for determining the buoyant rise of hot exhaust clouds or plumes from conflagrations, and descriptions of the multilayer diffusion models. A brief description of the computer program is given, and sample problems and their solutions are included. Derivations of the cloud rise formulas, users instructions, and computer program output lists are also included. Author

N73-28051# Joint Publications Research Service, Arlington, Va.
ORGANIZING THE INTERFACE OF THE HARDWARE OF LOCAL DATA CONTROL SYSTEMS WITH THE M-6000 ASVT-M COMPUTER COMPLEX
K. I. Didenko and I. S. Shandrin 25 Jul. 1973 11 p refs Transl. into ENGLISH from Prib. i Sistemy Upr. (Moscow), no. 5, 1973 p 5-8
(JPRS-59612) Avail: NTIS HC $3.00

The principles and technological means are reported for organizing the interface of the hardware of local data control systems with the M-6000 ASVT-M computer complex. Author

N73-28052*# Teledyne Brown Engineering, Huntsville, Ala. Science and Engineering.
DEVELOPMENT OF MULTIPLE USER AMTRAN ON THE DATACRAFT DC6024 Final Report, 25 Dec. 1971 - 23 Feb. 1973
S. L. Austin Jun. 1973 41 p refs
(Contract NAS8-26756)
(NASA-CR-124330; SE-MSFC-1731) Avail: NTIS HC $4.25 CSCL 09B

A multiple user version of AMTRAN was implemented on the Datacraft DC6024 computer is reported. The major portion of the multiple user logic is incorporated in the main program which remains in core during all AMTRAN processes. A detailed flowchart of the main program is provided as documentation of the multiple user capability. Activities are directed toward perfecting its capability, providing new features in response to user needs and requests, providing a two-dimensional array AMTRAN containing multiple user logic, and providing documentation as the tasks progress. Author

N73-28053# National Physical Lab., Teddington (England). Div. of Computer Science.
COMPUTER NETWORK SIMULATION STUDY
Roger Healey Jan. 1973 67 p refs Supersedes NPL-COM-SCI- 45
(NPL-COM-SCI-64; NPL-COM-SCI-45) Avail: NTIS HC $5.50

A proposed national UK packet switching network is analyzed by computerized simulation. The system is a store and forward network. Information traverses the network through a number of links, being stored in its entirety at the end of the link until it can be forwarded on another link. The system comprises a number of local networks, each of which collects information over a relatively small radius, and a high level network which connects all the local networks. The operation of the node computer is described. Simulation runs were made based on queues with a maximum size of only 3 packets. The low level of queue occupancy at which congestion begins is pointed out, and confirmed in later work. ESRO

N73-28054# European Space Operations Center, Darmstadt (West Germany).
USER'S MANUAL OF TMGL. A SELF-DESCRIBING METALANGUAGE
Tommaso Demico Paris ESRO Dec. 1972 103 p refs
(ESRO-SP-86) Avail: NTIS HC $7.25

A manual for the utilization of the TMGL self-describing metalanguage, with a bootstrapping feature, is presented. The aim of the manual is to provide the programming in TMGL with a reference guide, i.e. to list the semantic and syntactic features of this metalanguage, and also to show the logic underlying a program written in TMGL. Results from the theory of languages are used to clarify some of its peculiarities, examples being provided whenever they appear helpful. ESRO

N73-28055# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
THE DATA TRANSMISSION SECTION OF THE UNDERWATER SOUND MODEL TEST FACILITY AT WERTHHOVEN [DIE DATENUEBERTRAGUNGSSTRECKE DER WERTHHOVENER WASSERSCHALL- MODELL- VERSUCHSAN-

LAGE]
B. Naegele Nov. 1972 68 p In GERMAN
(Rept-5-72) Avail: NTIS HC $5.50

A signal processing system is described, consisting of an underwater sound basin (6m x 4m x 4m), a digital computer and a Fourier analyzer. The specifications for the total system could not be met by a set-up with commercial equipment because the digital computer was not compatible with the Fourier analyzer, and also in model tests the high data transmission rate as a result of dimensional reduction produced difficulties. Special components were developed to overcome these problems. The signals to be transmitted have a maximum frequency of 500 kHz and a bandwidth of about 100 kHz. The analog part of the signal processing is described briefly. ESRO

N73-28056# Interuniversitair Reactor Instituut, Delft Netherlands).
PATTERN RECOGNITION AS A STATISTICAL METHOD FOR ANALYZING THE CONFIDENCE LEVEL IN THE IDENTIFICATION OF OBJECTS
M. deBruin, P. J. M. Korthoven, R. P. W. Duin (Tech. Hogeschool Delft), F. C. A. Groen (Tech. Hogeschool Delft), and C. C. Bakels (Leiden Univ.) 1972 22 p refs
(IRI-133-72-11) Avail: NTIS HC $3.25

In order to analyze and identify the number of elements detectable in a sample, a problem especially important in forensic applications, a statistical indentification method based on a pattern recognition procedure is described. Each sample is represented by a point in a multidimensional concentration space. From the analytical data of groups of samples from various origins, the multidimensional probability distribution for each origin can be constructed. The position of the sample in the probability distribution of the assigned origin yields information about the confidence level of the indentification. This method has been developed and tested for identification of flint artifacts. ESRO

N73-28057# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ORGANIZATION OF AN INFORMATION COMPUTER CENTER IN AUTOMATIC SYSTEMS CONTROLLING ENTERPRISES
N. I. Kirilyuk and A. G. Sirchenko 21 May 1973 15 p Transl. into ENGLISH from Kibern. Vychislitelnaya Tekhn. (USSR), no. 12, 1971 p 120-124
(AD-761480; FTD-HT-23-461-73) Avail: NTIS CSCL 09/2

The functional composition of subdivisions of the ICC is determined proceeding from the technological process of information processing. Their numerical composition depends on the volume and complexity of the production produced by the enterprise, the changeability of operation of the enterprise, the quantity and frequency of the solution of the system problems, the quantity of technical means of the ASCE and subdivisions of the enterprise covered by its service, and the readiness of the enterprise for operation under conditions of functioning of the ASCE. GRA

N73-28058# University of Southern Calif., Los Angeles. Dept. of Industrial and Systems Engineering.
SELECTING A PROCESS MONITOR SCHEDULE WITH MULTIPLE RESOURCE CONSTRAINTS
Henry L. Pfister Jun. 1973 15 p refs Sponsored by Navy
(AD-761668; TR-2) Avail: NTIS CSCL 09/2

With plans to use time-sharing computers to control several simultaneous processes, the problem of scheduling the process sensors in a sample data control system is of increasing practical importance. The difficulties in scheduling arise from the necessity of sequencing optimal sensor combinations and from the optimal management of the system resources. In general the utility of a combination of sensors is not the sum of the individual utilities. Furthermore resource constraints are for long term utilization of the system. A sequencing and scheduling technique is described for this problem using a forward dynamic programming algorithm. The use of a forward algorithm allows the proof of a horizon theorem to find optimal time points to stop the scheduling process. (Modified Author Abstract) GRA

N73-28059# Mitre Corp., Bedford, Mass.
TACTICAL GROUND SURVEILLANCE SYSTEM MODEL COMPUTER PROGRAM DEVELOPMENT SPECIFICATION
G. R. Lacroix, M. L. Urban, and A. Neuburger Mar. 1973 118 p refs
(Contract F19628-73-C-0001; AF Proj. 8330)
(AD-761805; MTR-2474; ESD-TR-72-404) Avail: NTIS CSCL 15/7

The document specifies the performance characteristics of a computer program to simulate the operation of a general-purpose tactical ground sensor system. GRA

N73-28060# Naval Postgraduate School, Monterey, Calif. Dept. of Electrical Engineering.
A COMPUTERIZED ACOUSTIC IMAGING TECHNIQUE INCORPORATING AUTOMATIC OBJECT RECOGNITION
Dieter Erwin Mueller Mar. 1973 153 p refs
(AD-761497) Avail: NTIS CSCL 09/2

A computerized technique combining backward wave propagation and an automatic edge detection scheme is developed and tested. The class of objects considered is limited to those with edge boundaries since it is shown that a universal automatic reconstruction cannot be obtained for all possible objects. Using samples of the acoustic diffraction pattern as input this technique enables the computer to predict the most likely locations of objects and to produce graphical output of the objects. A discussion is given on implementing the diffraction equations on the computer. A simplified edge detection scheme conserving both memory space and computer time is described. Test results are presented for both computer generated diffraction patterns and one set of experimental data. Author (GRA)

N73-28061# Stanford Research Inst., Menlo Park, Calif.
A HIERARCHICAL ROBOT PLANNING AND EXECUTION SYSTEM Annual Report, 1 Apr. 1972 - 1 Apr. 1973
Nils J. Nilsson Apr. 1973 34 p refs
(Contract N00014-71-C-0294; SRI Proj. 1187)
(AD-761641) Avail: NTIS CSCL 09/2

The report describes a robot control program consisting of a hierarchically organized plan generation and execution system. The program is written in QA4 and makes use of several features of that language. The usually sharp distinction between robot plan generation and execution is intentionally blurred in this system in that planning and execution phases occur intermixed at various levels of the hierarchy. The system currently exists as a running program that clearly illustrates the concepts involved. Major additions and refinements would be necessary if the system were to be used to control an actual robot device.
Author (GRA)

N73-28062# Newark Coll. of Engineering, N.J. Dept. of Mechanical Engineering.
MATHEMATICAL PROGRAMMING PROCEDURES FOR MIXED DISCRETE-CONTINUOUS DESIGN PROBLEMS
Michael Pappas and Arnold Allentuch Apr. 1973 48 p refs
(Contract N00014-71-A-0124-0002)
(AD-761645; NCE-NV-7) Avail: NTIS CSCL 12/2

Two mathematical programming procedures for treating nonlinear problems involving mixed variables are presented. One involves a relatively simple concept. First an optimum is located treating all variables as continuous. Adjacent discrete points are then evaluated in order of increasing distance from the all-continuous optimum, each evaluation requiring an optimization of the continuous variables, if any, until a satisfactory design is found. The other method utilizes an optimal discrete search to locate the optimum. These procedures are applied to the minimum weight design of stiffened, cylindrical shells where they prove to be effective. Author (GRA)

N73-28063# State Univ. of New York, Albany. Albany Research Foundation.
CONFERENCE RECORD OF THE 1973 INTERNATIONAL SYMPOSIUM ON MULTIPLE-VALUED LOGIC Final Report
Charles M. Allen and Donald D. Givone May 1973 241 p refs Conf. held at Toronto, Canada, 24-25 May 1973 Sponsored in part by ONR
(AD-762123; MVL-73) Avail: NTIS CSCL 09/2

Contents: Multiple-valued variable-threshold threshold logic and its application to the realization of the set of boolean functions; Coordinate representation and structural invariants for many-

valued switching functions; The smallest many-valued logic for treatment of complemented and uncomplemented error signals; Obtaining self-testing logic through the application of threshold logic and an A.C. logic code; Multi-threshold circuits in the design of multi-state storage elements; Hazard-free realizations of Boolean functions using post functions; A balanced ternary computer; An approach to multi-valued sequential logic; Geometrical approach to multivalued logic function synthesis; On the generation of all the one variable functions in M-valued logic; Applying multiple-valued algebra concepts to neural modeling; A ternary positional automatic control system; Decomposition of ternary switching functions; Incremental curve generation using multiple-valued logic; Conditional and post algebra expressions; An application of many-valued logic to fault detection; Approximate logic; Multi-valued asynchronous circuits. GRA

N73-28064# Mitre Corp., Bedford, Mass.
DESIGN OF A SECURE COMMUNICATIONS PROCESSOR. VOLUME 1: OVERALL ENVIRONMENT AND CONCEPT
P. S. Tasker May 1973 35 p refs
(Contract F19628-73-C-0001; AF Proj. 7210)
(AD-761804; MTR-2439-Vol-1; ESD-TR-73-135) Avail: NTIS CSCL 09/2

The Secure Communications Processor is intended as a feasibility model for use in testing and verifying work concerned with the design and certification of security access controls for computer systems. The Processor was conceived to be hardware independent, but it is implemented on an Intercomputer Corporation I-50 communications processor. The report, one of five describing the design details, presents an introductory overview of the entire system. The design goals, deriving from certification and security requirements and applications requirements, are presented and their impact on the design is discussed. The report introduces the key design concept, a firmware-enforced stratification of the system by channel and by classification. Discussion of hardware, software, and memory organization illustrates how the concept is implemented. The volume concludes with a disucssion of loading and initialization requirements. An annotated bibliography on the ARPA Network is included. Author (GRA)

N73-28065# Illinois Univ., Urbana. Coordinated Science Lab.
OPTICAL COMPUTER-BASED CHARACTER RECOGNITION TECHNIQUE M.S. Thesis
Francis Joseph McNee May 1973 67 p refs
(Contract DAAB07-72-C-0259)
(AD-761882; R-606; UILU-ENG-73-2208) Avail: NTIS CSCL 09/2

The promise of obtaining a high speed pattern recognition system has been the stimulus for a great deal of work with coherent optics. The results, however, seem to lack the flexibility required of a functional system. An approach is proposed here, which addresses itself to this need. It contains both optical and digital features, in particular the use of filtering and the use of syntactic pattern description in place of templates or curve tracing. Developed in Chapter 2 is the background material for this topic. In Chapter three the pattern recognition problem is posed, difficulties associated with the problem are discussed and a solution is offered. The results of simulation, the test of the proposed approach, are analyzed in Chapter 4. Chapter 5 summarizes the conclusions drawn from this work.
Author (GRA)

N73-28066# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECIALIZED DIGITAL COMPUTER (TsVM) FOR CORRELATION ANALYSIS
G. Sh. Avetisov 16 May 1973 10 p Transl. into ENGLISH from Tr. Vses. Shkoly Seminara po Gidroakustike (USSR), 1970 p 181-185
(AD-761586; FTD-HT-23-238-73) Avail: NTIS CSCL 09/2

Principles used to construct a specialized digital computer for recognition and diagnostics purposes are outlined. Several correlation coefficients with random functions and high accuracy in real time are investigated. E.H.W.

N73-28067# Illinois Univ., Urbana. Coordinated Science Lab.
A SET OF ASYNCHRONOUS CONTROL MODULES M.S. Thesis
Charles Robert Paez Monzon May 1973 61 p refs
(Contract DAAB07-72-C-0259)
(AD-762345; R-610; UILU-ENG-2212-73) Avail: NTIS CSCL 09/2

The basic problem of designing a new digital system is: Given a set of primitive RT-modules, a method of assembling them into systems, and a specification in natural language of the behavior desired, create a system out of the components that has the desired behavior. The main goal of this study is to develop a set of register transfer primitive control modules that are designed in fundamental mode, in order to standardize a methodology of design and to relate it to classical combinational and sequential theory as presented in current logic design books and courses. GRA

N73-28068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF DIAGNOSING INACCURACIES IN ELECTRONIC DIGITAL COMPUTERS TAKING INTO ACCOUNT BREAKDOWN STATISTICS
A. M. Stepanov and V. E. Tatur 1 Jun. 1973 9 p Transl. into ENGLISH from "Tr. Vses. Soveshch. po Tekhn. Diagnostike", 1972 p 236-238
(AD-762235; FTD-HT-23-511-73) Avail: NTIS CSCL 09/2

An algorithm for diagnosing and localizing inaccuracies in electronic digital computers is presented. Experimental results are treated using probability procedures and statistical data are processed on operational breakdowns of the equipment. E.H.W.

N73-28069# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
PROGRAMS FOR SEQUENTIAL MACHINE DESIGN Interim Technical Report, Jan. 1972 - Feb. 1973
Subhash C. Gupta and John Staudhammer Feb. 1973 75 p refs Prepared in cooperation with AROD
(Grant DA-ARO(D)-31-124-72-G65)
(AD-762163; ITR-2) Avail: NTIS CSCL 09/2

The report describes four computer programs for the generation of sequential machine test cases. These programs are: Quine-McCluskey minimization; Simultaneous minimization of Multiple-output functions; Implicant generation from non-fundamental product terms (iterative consensus); Automatic minterm generation; Minimized excitation equations (2-levels) for a sequential machine given a minimal flow table and all codes. The programs are checked out on an IBM 370/165 system and can handle up to 32 variables simultaneously.
Author (GRA)

N73-28070# Utah Univ., Salt Lake City. Computer Science Div.
REAL TIME MEASUREMENT OF MULTIPLE THREE DIMENSIONAL POSITIONS
Robert Preece Burton Jun. 1973 127 p refs Sponsored in part by ARPA
(Contract F30602-70-C-0300)
(AD-762028; UTEC-CSC-72-122) Avail: NTIS CSCL 09/2

A hardware-software system has been built which measures the three-dimensional positions of multiple points. In most cases, the points are light-emitting diodes which may be attached to wands, gloves, clothing, etc. The light-emitting diodes are easily distinguished from one another by flashing them on and off in sequence, under computer control. The position of a light source is measured by scanning the environment. Fast one-dimensional, geometric scans quickly determine planes in which a light source lies. The point of interest is at the intersection of these planes. (Modified Author Abstract) GRA

N73-28071# Illinois Univ., Urbana. Coordinated Science Lab.
ANALYSIS OF LANGUAGES FOR THE DESIGN OF DIGITAL COMPUTERS M.S. Thesis
Mario Albarran Figueroa May 1973 134 p refs
(Contract DAAB07-72-C-0259)
(AD-762381; R-611; UILU-ENG-73-2213) Avail: NTIS CSCL 09/2

The process of design automation is reviewed, the methodol-

ogy of design is explored and from there, the principal characteristics of the representational parts of the design automation system are discussed. Design languages are classified according to their goals and a summary of the most important languages is made. Author (GRA)

N73-28072# Frankford Arsenal, Philadelphia, Pa.
MAIDS STUDY, TMDE TASK 05: INFORMATION DYNAMICS. COMPUTER SOFTWARE (PROBLEMS AND POSSIBLE SOLUTIONS)
Edward Lieblein Apr. 1973 34 p refs
(DA Proj. 1J6-62601-AJ-29)
(AD-762141; FA-M73-13-1) Avail: NTIS CSCL 09/2

Software systems fail when delivered, during acceptance testing, and throughout the life of the systems. The reasons for their failure are explored and means to prevent or overcome these problems are suggested. The latter include development and use of good documentation standards; use of improved software design techniques (described as defensive programming) and of good high level languages; design of adequate tests concurrent with the software design process; and adequate preparation for hardware/software integration. Author (GRA)

N73-28073# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REALIZATION OF EVEN PARITY CHECK OF THE NUMBER OF ONES IN BINARY NUMBERS IN A DIGITAL COMPUTER
G. D. Vachiberidze 5 Jun. 1973 7 p refs Transl. into ENGLISH from Tr. Vses. Soveshchanie po Tekh. Diagnostike (USSR), 1972 p 348-349
(AD-762245; FTD-HT-23-507-73) Avail: NTIS CSCL 09/2

The checking of storage (read-out) and transmission of instrumental, numerical and address information in a digital computer with the help of parity of ones in the number code is discussed. Even parity check is reduced to mod 2 addition of the binary numbers of the number code. Even parity check of the number of ones in binary numbers can be realized via software or hardware. Software methods make it possible to determine the parity of ones without additional equipment, but in this case, specific instructions of the general-purpose TsVM are required, as well as an increase in its storage. Problem solving in this case is made more complex, and resolution time is significantly increased. Author

N73-28074# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROGRAM LOCALIZATION OF MALFUNCTIONS IN COMPUTER COMPLEXES
Y. N. Nikolskaya, V. E. Tatur, and M. V. Tikhonova 31 May 1973 14 p Transl. into ENGLISH from Tr. Vses. Soveshch. Tekhn. Diagnestike (USSR), 1972 p 22-25
(AD-762310; FTD-HT-23-522-73) Avail: NTIS CSCL 09/2

The diagnosing of modern computer complexes is quite complex in view of the great volume of equipment, the complexity of circuits, and the temporary relationships in the operation of the various elements which are included in their composition. In the present article an analysis is made of the algorithms for the construction of a system of diagnositc programs for modern computer complexes, the characteristics of these algorithms, and also the methods of diagnosis used in the proposed diagnostic system. GRA

N73-28075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL METHOD OF DETECTING ERRORS IN DIGITAL CONTROL COMPUTERS
B. I. Klebanov 8 Jun. 1973 8 p refs Transl. into ENGLISH from Tr. Vses. Soveshchanie po Tekhnicheskoi Diagnostike (USSR), 1972 p 62-63
(AD-762241; FTD-HT-23-518-73) Avail: NTIS CSCL 09/2

The paper examines an algorithm for detecting computation errors. The algorithm is based on filtration of the noise caused by digital-computer failure against a background of the useful signal. Also considered are questions of realizing this algorithm in a program monitored by a digital computer with a limited time for the check operations. GRA

N73-28076# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS IN THE DEVELOPMENT OF PROGRAMS FOR THE DIAGNOSIS OF MALFUNCTIONS IN DEVICES IN A DIGITAL COMPUTER SYSTEM
I. O. Atovmyan, M. I. Arshavskii, Yu. G. Drevs, and V. V. Zolotarev 31 May 1973 14 p Transl. into ENGLISH from Tr. vses. Soveshchenie Tekhn. Diagnostike (USSR) 1972 p 57-61
(AD-762237; FTD-HT-23-519-73) Avail: NTIS CSCL 09/2

At the present time the development of a method for the construction and methods of organization of the operation of programs for the diagnosis of malfunctions in digital devices has become pressing. The presence of such a method eases the development of diagnostic programs and is one of the phases in the automation of their construction. In the present work an attempt is made to generalize the engineering experience accumulated by the authors in the compilation of diagnostic programs for devices included in the composition of a digital computer system. GRA

N73-28077# Utah Univ., Salt Lake City. Computer Science Div.
HIDDEN SURFACE LINE DRAWING ALGORITHM
Michael Archuleta Jun. 1972 76 p refs Sponsored in part by ARPA
(Contract F30602-70-C-0300)
(AD-762023; UTEC-CSC-72-121) Avail: NTIS CSCL 09/2

The paper describes a fast procedure in processing hidden surface pictures with the output in vector form. The program has been written expressly for a Decsystem 10 and has performed successfully on three different installations. The algorithm which is being used is a modification to the Watkins' Algorithm. Consequently, the program has inherited many key features which provide for speed, compactness, and flexibility. Author (GRA)

N73-28078# Illinois Univ., Urbana. Coordinated Science Lab.
DECISION GRAPHS FOR INFORMATION PROCESS
Wataru Mayeda Mar. 1973 34 p refs
(Contract DAAB07-72-C-0259)
(AD-761877; R-600; UILU-ENG-73-2202) Avail: NTIS CSCL 12/2

Identifying and classifying information are important tasks in many areas such as data processing in census studies, process controls in information processing systems, the recognition of patterns, and so on. Here the author develops a procedure to design a reasonable testing process to identify information from a given decision table. There are several papers dealing with decision trees and decision tables. In the paper, the author attacks the problem by the use of linear graph theory so that more general cases of identifying information can be covered. (Modified Author Abstract) GRA

N73-28079# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBABILITY FORECASTING OF MALFUNCTION POINTS IN COMPUTERS
M. S. Shcherbinin and B. F. Ivanov 1 Jun. 1973 11 p refs Transl. into ENGLISH from Tr. Vses. Soveshchanie po Tekh. Diagnostike (USSR), 1972 p 64-66
(AD-762263; FTD-HT-23-517-73) Avail: NTIS CSCL 09/2

The authors discuss a statistical approach to predict the location of a possible malfunction in a computer. GRA

N73-28080# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF DETERMINATION OF A DIAGNOSTIC NUCLEUS OF A DIGITAL COMPUTER
B. M. Kagan and I. B. Mkrtumyan 31 May 1973 10 p refs Transl. into ENGLISH from Tr. Vses. Soveshchanie po Tekhn. Diagnsotike (USSR), 1972 p 52-53
(AD-762264; FTD-HT-23-521-73) Avail: NTIS CSCL 09/2

The construction of a digital computer with means for the automatic diagnosis of malfunctions is discussed. E.H.W.

N73-28081# Naval Research Lab., Washington, D.C.
ON THE FEASIBILITY OF EMULATING THE AN/UYK-7 COMPUTER ON THE AADC SIGNAL PROCESSING ELEMENT

Tomlinson G. Rauscher Nov. 1972 36 p refs
(WF21241601)
(AD-761610; NRL-MR-2525) Avail: NTIS CSCL 09/2

The All Applications Digital Computer (AADC) will eventually replace the AN/UYK-7, the Navy's present standard computer; hence, it is important to determine the feasibility of emulating the AN/UYK-7 on the AADC. The AN/UYK-7 computer is difficult to emulate because it achieves its speed through concurrent and irregular use of its internal facilities. The Signal Processing Element (SPE), a part of the AADC, when slightly modified, however, becomes a capable host machine for emulating the AN/UYK-7. The authors demonstrate this with SPE routines which emulate the AN/UYK-7 instruction fetch and seven instruction execution routines. Discussed briefly are additional AN/UYK-7 instructions and it is concluded that the SPE can emulate AN/UYK-7 programs at a speed between half real time and real time. Author (GRA)

N73-28082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FUNCTION, PRINCIPLES OF CONSTRUCTION AND TECHNICAL CHARACTERISTICS OF A NUMBER OF CHECKING GENERAL-PURPOSE COMPUTERS OF THE PUMA TYPE

P. P. Parkhomenko, E. S. Sogomonyan, and Yu. L. Tomfeld 8 Jun. 1973 11 p refs Transl. into ENGLISH from Tr. Vses. soveshchanie po Tekhnicheskoi Diagnostike (USSR), 1972 p 303-306
(AD-762212; FTD-HT-23-509-73) Avail: NTIS CSCL 09/2

The modern trend in the development of external hardware of the checking of the technical state of complex objects and the transition to the creation of general-purpose logic checking computers controlled by a replaceable program is discussed. Such computers make it possible to change widely the programs and volumes of checks and overcome the shortcomings inherent in the hardware of automatic checking. The main advantages of the PUMA are: (1) reduction in the periods of assimilation by the production of products with the exception of the stage of the development and adjustment of the controlled equipment for them; (2) the reduction in the laboriousness of the creation of checking equipment with respect to the laboriousness of the checks fulfilled by them; (3) the high objectivity of the checks and tests; (4) the possibility of the automation of checks and tests (unification allows rapidly adjusting the mass production of the general-purpose external hardware of the checking); (5) the reduction of personnel engaged in the development, adjusting and (6) operation of specialized monitoring equipment. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N73-28083* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROCESS FOR MAKING RF SHIELDED CABLE CONNECTOR ASSEMBLIES AND THE PRODUCTS FORMED THEREBY Patent

Aaron Fisher and Carroll H. Clatterbuck, inventors (to NASA) Issued 10 Jul. 1973 7 p Filed 12 Feb. 1971 Supersedes N72-10192 (10 - 01, p 0029)
(NASA-Case-GSC-11215-1; US-Patent-3,744,128; US-Patent-Appl-SN-114873; US-Patent-Class-29-629; US-Patent-Class-29-628; US-Patent-Class-29-630; US-Patent-Class-29-630A) Avail: US Patent Office CSCL 09A

A process for making RF shielded cable connector assemblies and the resulting structures is described. The process basically consists of potting wires of a shielded cable between the cable shield and a connector housing to fill in, support, iegidize, and insulate the individual wires contained in the cable. The formed potting is coated with an electrically conductive material so as to form an entirely encompassing adhering conductive path between the cable shield and the metallic connector housing. A protective jacket is thereby formed over the conductive coating between the cable shield and the connector housing.
Official Gazette of the U.S. Patent Office

N73-28084* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PSEUDONOISE (PN) SYNCHRONIZATION OF DATA SYSTEM WITH DERIVATION OF CLOCK FREQUENCY FROM RECEIVED SIGNAL FOR CLOCKING RECEIVER PN GENERATOR Patent

Lucien A. Couvillon, Jr., inventor (to NASA) Issued 17 Sep. 1968 11 p Filed 12 Jul. 1965 Sponsored by NASA
(NASA-Case-XNP-03623; US-Patent-3,402,265; US-Patent-Appl-SN-471154; US-Patent-Class-178-69.5) Avail: US Patent Office CSCL 09A

A digital communicating system for automatically synchronizing signals for data detection is described. The system consists of biphase modulating a subcarrier frequency by the binary data and transmitting a carrier phase modulated by this signal to a receiver, where coherent phase detection is employed to recover the subcarrier. Data detection is achieved by providing, in the receiver, a demodulated reference which is in synchronism with the unmodulated subcarrier in transmitting system. The output of the detector is passed through a matched filter where the signal is integrated over a bit period. As a result, random noise components are averaged out, so that the probability of detecting the correct data transmitted is maximized.
Official Gazette of the U.S. Patent Office

N73-28085*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

FLAT CONDUCTOR CABLE DESIGN, MANUFACTURE, AND INSTALLATION

W. Angele and James D. Hankins 16 Apr. 1973 438 p refs
(NASA-TM-X-64750) Avail: NTIS HC $24.00 CSCL 09A

Pertinent information for hardware selection, design, manufacture, and quality control necessary for flat conductor cable interconnecting harness application is presented. Comparisons are made between round wire cable and flat conductor cable. The flat conductor cable interconnecting harness systems show major cost, weight, and space savings, plus increased system performance and reliability. The design application section includes electrical characteristics, harness design and development, and a full treatise on EMC considerations. Manufacturing and quality control sections pertain primarily to the developed conductor-contact connector system and special flat conductor cable to round wire cable transitions. Author

N73-28086*# Scientific Translation Service, Santa Barbara, Calif.

COOLABLE CALIBRATING RESISTANCE AS NOISE TEMPERATURE STANDARD

P. G. Mezger and H. Rother Washington NASA Aug. 1973 18 p refs Transl. into ENGLISH from Frequenz (West Berlin), v. 16, no. 10, 1962 p 386-391
(Contract NASw-2483)
(NASA-TT-F-15016) Avail: NTIS HC $3.00 CSCL 09C

An examination was made of noise temperature standards set up to measure low noise temperature of preamplifiers, antennas, and receiving systems. Particular attention was given to calibrating noise generators. E.H.W.

N73-28087*# Westinghouse Electric Corp., Elmira, N.Y. Electronic Tube Div.

APOLLO TELESCOPE MOUNT SEC CAMERA TUBE SPARES PROGRAM Final Report

M. Green and R. D. Harder Jun. 1973 51 p
(Contract NAS8-29063)
(NASA-CR-124342) Avail: NTIS HC $4.75 CSCL 09A

An important engineering improvement was made during the Spares Program. The thermionic cathode structure was modified to bring the cathode temperature to a more suitable value and shields were placed over the glass-to-metal interface of the stem leads to reduce the possibility of interelectrode leakage. The cathode temperature change has resulted in a corresponding change in the recommended operating conditions for the heater of the thermionic cathode. All tubes built during the 1972-

1973 ATM Spares Program should be operated with a heater current of 150 mA (6.3 volts). Operation at lower currents and voltages adversely affects the life of these tubes. Author

N73-28088# Sheffield Univ. (England). Dept. of Electronic and Electrical Engineering.
REFLECTION AMPLIFICATION FROM SUPERCRITICAL GUNN DIODES AT X AND Q BAND Annual Report, Oct. 1971 - Sep. 1972
Sep. 1972 45 p refs
(Contract ESTEC-1406/71-AA)
(ESRO-CR(P)-262) Avail: NTIS HC $4.25

The behavior of GaAs reflection amplifiers around the X band and at high power levels was investigated. In particular, the effect of the doping profile on the stabilization mechanism through computer simulation was studied. The possibilities of using GaAs reflecting amplifiers in the millimeter region of the spectrum also investigated.

N73-28089 Sheffield Univ. (England).
MICROWAVE GaAs REFLECTION AMPLIFIERS AROUND X BAND
R. Charlton *In its* Reflection Amplification from Supercritical Gunn Diodes at X and Q Band Sep. 1972 19 p refs (For availability see N73-28088 19-09)

The continuation of work on X band reflection amplifiers using supercritically doped Gunn diodes is described. To overcome the impossibility of tuning the center frequency of the gain response using a trough line coaxial mount as in previous experiments, a reduced height w/g mount, which allows transverse movement of the Gunn diodes, was constructed. The transverse movement of the diode allows tuning of the center frequency, and adjustment of a short circuit behind the diodes tunes the gain and bandwidth. The effects of cathode doping notch size, profile, and temperature on the minimum voltage were investigated. It was found that the inclusion of a mobility notch at the cathode rather than a doping notch gives very similar results. ESRO

N73-28090 Sheffield Univ. (England).
SOME PROPERTIES OF GaAs AND InP REFLECTION AMPLIFIERS IN Q BAND (35 GHz)
S. Baskaran *In its* Reflection Amplification from Supercritical Gunn Diodes at X and Q Band Sep. 1972 23 p refs (For availability see N73-28088 19-09)

The effect of temperature on gain, frequency response, and noise figure of amplifiers was studied over a temperature range of about 60 C above ambient. In general, for a given bias voltage, it was found that gain increases with temperature and noise figure decreases. The stability of the amplifiers is also influenced by the temperature. As the temperature rises, the GaAs amplifiers become increasingly stable over a reduced voltage range. Some noise figure measurements have been done on a number of InP diodes. The lowest noise figure measurements were done on a number of InP diodes and the lowest figure was about 11 db; a spread of about 4 db was noted in the noise figure values for ten diodes tested. These results confirm that, in general, the noise figure of InP devices are at least about 7 db less than those for GaAs ones. ESRO

N73-28091# Fom-Instituut voor Plasmafysica, Jutphaas (Netherlands).
COMPUTATIONS CONCERNING A MULTIPACTOR DISCHARGE
H. Bremmer (Tech. Hogeschool Eindhoven) Feb. 1973 24 p Sponsored in part by Neth. Organ. for Pure Sci. Res. (ZWO) and EURATOM
(Rept-73-74) Avail: NTIS HC $3.25

These computations concern electronic densities in the interspace between two parallel flat electrodes, each of which can generate secondary electrons, in the presence of an alternating current field. The distribution function for the (one-dimensional) coordinate and velocity of these electrons satisfies an inhomogeneous Vlasov equation which, in turn, leads to two consistency relations. The latter refer to the rates of arrivals of electrons at, and departures away from the two electrodes. The asymptotic behavior of these relations shows the preponderant role, in the long run, of electrons having a special velocity the time dependence of which has the same period as the alternating current voltage. This property leads to a plausible approximation for the mentioned rates of arrivals and departures. Author (ESRO)

N73-28092# Fairchild Space and Defense Systems, Syosset, N.Y.
FLOATING GATE AMPLIFIER Final Report
22 Mar. 1973 97 p refs
(Contract N00014-72-C-0344)
(AD-761660) Avail: NTIS CSCL 09/5

The report presented the theoretical study and experimental results of a single stage floating gate amplifier. The calculation and optimization of the floating gate responsivity were performed using both numerical and analytical methods. GRA

N73-28093# Naval Postgraduate School, Monterey, Calif.
STUDY OF HETEROJUNCTION Pb(1-X)Sn(X)Te DIODES M.S. Thesis
Jose Manuel Fernandez Dec. 1972 88 p refs
(AD-761767) Avail: NTIS CSCL 09/1

A new procedure of using metal rich (Pb(1-x)Sn(x))(1-)Te alloy source in a graphite boat deposition method has been developed in preparing n-type Pb(0.8)Sn(0.2)Te thin films of carrier concentration in the low 10 to the 17th power/cc range without annealing. Using this procedure, single heterojunction Pb(1-x)Sn(x)Te diodes have been made by sequential depositions of p-type Pb(0.86)Sn(0.14)Te and n-type Pb(0.80)Sn(0.20)Te thin films on cleaved (100) KCL substrates. Diodes were made by using gold deposition and silver epoxy contacts. Rectifying diodes of (R sub o)A values as high as 600 ohm-sq cm have been obtained. A theoretical analysis was carried out in calculating the laser performance of a double heterojunction Pb(1-x)Sn(x)Te diodes. Its results will be used as guidelines for continuing experimental research and development. Author (GRA)

N73-28094# Clarkson Coll. of Technology, Potsdam, N.Y.
ELECTRO-THERMAL OVERSTRESS FAILURE IN MICROELECTRONICS Final Technical Report
Henry Domingos Apr. 1973 195 p refs
(Contract F30602-72-C-0007)
(AD-761792; RADC-TR-73-87) Avail: NTIS CSCL 09/5

Failure of microelectronic circuits caused by electrical overstress was investigated theoretically and experimentally. Computer calculations on heat flow in silicon structures pointed out the necessity of using temperature dependent thermal constants for silicon. The effect of surface layers and power distribution on the peak temperature in silicon devices under transient conditions was investigated. Integrated circuits representing several fabrication technologies from several different manufacturers were pulsed to failure over pulse lengths from 100 nsec to 10 msec. The threshold power per unit area to produce permanent damage was found to vary by a factor of 20 among the parts tested. Peak temperatures to initiate current construction were estimated to be 1000-1200C. Author (GRA)

N73-28095# Naval Postgraduate School, Monterey, Calif.
SLOT LINE TRANSITIONS M.S. Thesis
Donald Albert Moses Mar. 1973 53 p refs
(AD-761765) Avail: NTIS CSCL 09/1

The slot line to coaxial line transition and the slot line to microstrip transition are investigated. Theoretical VSWR versus frequency curves for both transitions are computed and compared to experimental results. Technique for measuring slot line VSWR are discussed. Author (GRA)

N73-28096# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
CAPACITANCE AND EQUIVALENT AREA OF A HOLLOW SINGLE GAP PROLATE/OBLATE SPHEROIDAL ELECTROMAGNETIC PULSE SENSOR M.S. Thesis
Larry W. Wood Jun. 1973 92 p refs
(AD-761801; GE/PH/73S-1) Avail: NTIS CSCL 09/5

Electromagnetic sensors of various geometric configurations are used to measure the nuclear electromagnetic pulse. Certain design parameters exist for these sensors and are so related that if any two are known, the others are also known. For dipole sensors, the two most readily calculable parameters are

capacitance and equivalent area. The capacitance and equivalent area are calculated for both prolate and oblate hollow single-gap dipole sensors for various ranges of eccentricity and gap-size. The method used is a finite difference scheme in matrix form which solves Laplace's equation in spheroidal coordinates with mixed boundary conditions. The computations are performed on a CDC 6600 digital computer, and a sequence-to-sequence limiting procedure is used to improve the accuracy of the solution. The results are presented in graphical form and the validity of the method is discussed. Recommendations are made for improving the method. Author (GRA)

N73-28097# Mitre Corp., Bedford, Mass.
A FLEXIBLE HARDWIRED FAST FOURIER TRANSFORM DIGITAL PROCESSOR
G. C. OLeary and E. A. Palo Mar. 1973 50 p refs
(Contract F19628-71-C-002; AF Proj. 7028)
(AD-761803; MTR-2330; ESD-TR-72-146) Avail: NTIS CSCL 09/2

A hardwired digital processor based on the Cooley-Tukey algorithm is presented. A laboratory prototype has been built with two modes of operation. As a cascade fast Fourier transformer, it can simultaneously calculate transforms of two independent, continuous data streams at word rates in excess of 3 MHz. As a nonrecursive digital filter, it can produce filter impulse responses of up to 32 points. The digital filter also operates from data source with word rates exceeding 3 MHz. The processor has been integrated into a system with other signal processing components including a small general purpose computer. Laboratory demonstration of the processing system as a spectrum analyzer and as an adaptive filter for distortion correction is discussed. Author (GRA)

N73-28098# General Electric Co., Syracuse, N.Y. Heavy Military Electronic Systems.
LOW VOLUME HIGH POWER RADIATING TRANSMITTER Final Report, Nov. 1971 - Nov. 1972
Gordon F. Stuart and George F. Farrell, Jr. Apr. 1973 77 p ref
(Contract F30602-72-C-0074; AF Proj. 5573)
(AD-761793; RADC-TR-73-113) Avail: NTIS CSCL 09/5

The document represents a description of an antenna array consisting of densely-packed radiating elements, each capable of being driven from an individual transistor amplifier. Significant results are presented in detail. Questions concerning the optimum number of radiating elements for a given aperture size, radiation pattern, antenna gain and efficiency, and deviations from optimum performance as a function of scan angle are answered.
Author (GRA)

N73-28099# Naval Postgraduate School, Monterey, Calif.
FEASIBILITY STUDY OF Pb(1-X)Sn(X)Te CHARGE COUPLED DEVICES FOR INFRARED IMAGING APPLICATIONS M.S. Thesis
Alan Jeffrey Doshier Mar. 1973 86 p refs
(AD-761473) Avail: NTIS CSCL 09/1

The purpose of this research was to examine the feasibility of narrow-gap semiconductor charged coupled devices for infrared imaging applications. The semiconductors considered are PbTe for a three to five micron imager and Pb(0.76)Sn(0.24)Te for an eight to 12 micron imager, both operated at a temperature of 85K. Theoretical calculations of signal current and storage time are made based on the metal-insulator-semiconductor theory developed for silicon MIS devices. Experimental studies of Pb(1-x)Sn(x)Te MIS were made which demonstrated that accumulation, depletion, and inversion layers can be controlled by gate voltage, following the general behavior of silicon MIS devices. A PbTe charged coupled dzvice (CCD) infrated imager seems feasible. Feasibility of Pb(0.76)Sn(0.24)Te CCD's will require significant improvements in material and fabrication technology to increase storage time and reduce dark current. (Modified Author Abstract) GRA

N73-28100# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE INSULATED LOOP ANTENNA IN A DISSIPATIVE MEDIUM
Glenn S. Smith Apr. 1973 104 p refs
(Contract N00014-67-A-0298-0005; NR Proj. 371-016)
(AD-762041; TR-637) Avail: NTIS CSCL 09/5

The performance of a bare antenna as a radiator in a dissipative medium can be significantly altered by placing a dielectric coating around the antenna. For certain antenna types and specific properties of the dissipative medium, the dielectric insulation has been shown to improve the performance of the antenna. In this paper a thin wire circular loop antenna centered in an insulating spherical cavity and immersed in an infinite homogeneous isotropic dissipative medium is analyzed. A Fourier series solution for the antenna current distribution is derived. The coefficients of the series are a combination of the coefficients for the loop in an infinite dielectric medium, which were determined previously by Wu, and a second term, which is an infinite sum. The properties of the sum are examined and expressions for the antenna input admittance, impedance and electromagnetic field in the dissipative medium are obtained. Numerical results are presented for specific antenna sizes and dissipative media. (Modified Author Abstract) GRA

N73-28101# Stanford Research Inst., Menlo Park, Calif.
NOVEL SURFACE ACOUSTIC WAVE TRANSDUCER TECHNIQUES Final Report
Eugene R. Westerberg Apr. 1973 65 p refs
(Contract DAHC15-72-C-0265; DARPA Order 2198; SRI Proj. 1909)
(AD-761625) Avail: NTIS CSCL 09/1

The research demonstrates that a new electron-beam image projection exposure technique, the slit-lens, can be applied to the fabrication of high resolution interdigital patterns for use as high frequency surface acoustic wave transducers. Further research efforts include the development of the ancillary thin-film techniques for making metallic patterns on piezoelectric substrates, and the design, fabrication, and electrical test of actual surface acoustic wave delay lines produced by the foregoing techniques. Author (GRA)

N73-28102# Naval Postgraduate School, Monterey, Calif.
CODING AND QUANTIZATION LOSSES FOR THE COHERENT WHITE GAUSSIAN CHANNEL M.S. Thesis
Boon J. Rit Nualprasert Dec. 1972 39 p refs
(AD-761465) Avail: NTIS CSCL 09/4

Communication of binary data over an additive white Gaussian channel by means of coded transmission over coherent phase-shift keyed modems is considered. It is found that for high rate codes and coarse receiver output quantization, the minimum value of (E sub b)/(N sub 0) required for reliable communication is significantly higher than the Shannon limit of -1.6 dB. for the raw channel. This loss of efficiency is investigated quantitatively as a function of code rate and coarseness of quantization, and shown to be negligible for low rate code with fine quantization. Similar results are presented showing the minimum (E sub b)/(N sub 0) ratio for operation in the region where a sequential decoder performs finite average computation. In connection with this, tables and curves are given which show the value of the Pareto parameter rho as a function of (E sub b)/(N sub 0).
Author (GRA)

N73-28103# Naval Radiological Defense Lab., San Francisco, Calif.
COMPUTER SOLUTION OF HALLEN'S EQUATION ON MULTI-ELEMENT ARRAYS EMPLOYING THE TWO TERM APPROXIMATE CURRENT DISTRIBUTION M.S. Thesis
C. W. Schillinger Mar. 1973 60 p refs
(AD-761471) Avail: NTIS CSCL 09/5

The objective of the analytical study was to develop a rapid theoretical analysis on approximate half wavelength elements of an antenna configured in a co-planar, symmetrical array. A computer program was written employing the method of moments approach to the solution of Hallen's integral equation with an approximate two term entire domain expansion assumed for the current distributions. With the solution of the current distributions on each element, additional calculations were made for the input impedance and admittance values, field distributions, power gain, and a graphical output of the radiation pattern. Author (GRA)

N73-28104# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

DEVICE IMPLICATIONS OF ION IMPLANTATION DAMAGE IN SILICON

D. Eirug Davies and Sven A. Roosild 30 Apr. 1973 8 p refs Presented at the Proceedings of the 1972 Govt. Microcircuit Appl. Conf., San Diego, Oct. 1972

(AD-761486; AFCRL-TR-73-0290) Avail: NTIS CSCL 09/1

Thermal stimulated current and diode recovery measurements are presented for ion implanted silicon. The results are used to evaluate device possibilities such as bipolar transistors and hyperabrupt diodes where control of implantation damage is critical. Author (GRA)

N73-28105# Illinois Univ., Urbana. Coordinated Science Lab.

DETERMINATION OF THE ELECTROMECHANICAL COUPLING COEFFICIENT OF AN INTER-DIGITALLY POLED TRANSDUCER ON A PIEZOELECTRIC CERAMIC

James Randal Moulic Apr. 1973 47 p refs

(Contract DAAB07-72-C-0259)

(AD-761879; R-602; UILU-ENG-73-2204) Avail: NTIS CSCL 09/1

An interdigital surface wave transducer on a piezoelectric ceramic with the polarization directed from one comb to the other is described. The electromechanical coupling coefficient and electrical efficiency as a function of poling strength are determined from driving point impedance measurements. Author (GRA)

N73-28106# Harry Diamond Labs., Washington, D.C.

EFFECTS OF RESISTIVITY ON THE CURRENT INDUCED IN AN INFINITE CIRCULAR CYLINDER BY A PLANE WAVE

Egon Marx Jan. 1973 21 p ref

(HDL Proj. E142E6)

(AD-762165; HDL-TR-1617) Avail: NTIS CSCL 20/3

An expression was found for the axial conduction current induced in an infintely long circular cylinder in free space with a small resistivity by an incident electromagnetic plane wave. A study was made of the qualitative changes in the late-time behavior of the response to a pulse and the limiting case for small angles between the axis of the cylinder and the direction of propagation of the wave when compared to the case of a perfectly conducting cylinder. (Modified Author Abstract) GRA

N73-28107# General Electric Co., Utica, N.Y. Aerospace Electronic Systems Dept.

DEVELOPMENT OF MICROCIRCUIT BOND-PULL SCREENING TECHNIQUES Final Report, 21 Dec. 1971 - 1 Dec. 1972

Anthony P. Bertin Apr. 1973 102 p refs

(Contract F30602-72-C-0185)

(AD-762333; RADC-TR-73-123) Avail: NTIS CSCL 09/5

The development of microcircuit bond-pull screening techniques was undertaken to determine if prestressing of interconnecting wire bonds within a microcircuit package would be a feasible technique for removing weak bonds prior to sealing. The primary concern was determining if prestressing was destructive to the long life of the bonds. Test samples included both gold and aluminum 1 mil wire bonds, fabricated in two different package configurations, providing variations in wire length and loop height. The wire bonds were prestressed at a pull strength level equivalent to 40% of the average breaking strength of the wire. Both prestressed and unprestressed bonds were subjected to a testing program of package processing, MIL-STD-883 Class B screening and accelerated life testing. The results showed that prestressing, even at the relatively high levels used, had no long term degrading effect on the reliability of wire bonds and was a very useful screen for detecting poorly made bonds. The technique may be used as a 100% screen or as a product sampling test for bonding control. Cost factors may limit its usefulness. (Modified Author Abstract) GRA

N73-28108# Northrop Corp., Palos Verdes Peninsula, Calif. Electronics Div.

DIGITAL ADDRESS THIN DISPLAY TUBE Quarterly Report, 15 Aug. - 15 Nov. 1972

W. F. Goede Mar. 1973 23 p refs

(Contract DAAB07-72-C-0076; DA Proj. 1S6-62705-A-005) (AD-762115; NORT-72-28C-3; ECOM-0076-3-72: QR-3) Avail: NTIS CSCL 09/2

The report describes the progress which occurred during the third quarter of a Research and Development contract to develop a 512x512 resolution element display with a resolution of 55 holes-per-inch. This digitally addressed thin display tube is being developed to evaluate and demonstrate the feasibility of using this display concept to meet Army requirements for a computer output display. During the third quarter, the design was tested using a 160 x 256 resolution-element device at 55 holes-per-inch. This allowed the cathode design, switching-plate configuration, and electronic design to be tested before the full device was built. (Modified Author Abstract) GRA

N73-28109# Hughes Research Labs., Malibu, Calif.

MILLIMETER WAVE IMAGE CONVERSION PANELS Semiannual Report, 1 Apr. - 30 Sep. 1972

J. M. Baird and D. A. Kiewit Feb. 1973 23 p

(Contract DAAB07-72-C-0119; DA Proj. 1S6-62705-A-056) (AD-762116; ECOM-0119-1) Avail: NTIS CSCL 09/1

Work to further develop semiconductor image dissecting panels for mm wave imaging is described. A description is given of a new mechanical assembly design that will simplify the construction of these panels. This design uses a polystyrene lens as the basic supporting structure on which the pre-assembled and pretested panel elements are mounted. Diode development work is also described. It has led to diodes in which the bulk resistivity can be changed from 3000 ohms-cm to about 5 ohms-cm by the application of a forward bias of 0.5 A/sq cm. These p-i-n diodes have an Al-alloy p + region and an As-ion implanted n + region with Pt-Si-Ti-Pt-Au for contacting metallization. They are capable of providing > 30 db rf modulation in image conversion panel applications. Author (GRA)

N73-28110# Naval Civil Engineering Lab., Port Hueneme, Calif.

AN EXPERIMENTAL INVESTIGATION FOR DETERMINING SUSCEPTIBILITY LIMITS AND TECHNICIANS FOR DESENSITIZATION OF SOLID STATE ELECTRONIC EQUIPMENT TO POWER LINE TRANSIENTS

Maurice N. Smith Apr. 1973 53 p refs

(YF53534)

(AD-762403; NCEL-TN-1256) Avail: NTIS CSCL 14/2

Government and commercial facilities are becoming more operationally dependent on sensitive and complex electronics systems. These systems require precise and continuous supply of electric power for trouble-free operation. Desensitization of sensitive electronic equipment to power supply abnormalities is one approach toward achieving increased operational reliability. This report covers the results of an experimental investigation to determine the susceptibility limits of a selected solid state electronic test unit and to evaluate techniques for desensitizing the unit to a variety of typical power line transients. It was concluded that when sensitive electronic systems are being developed, susceptibility tests should be performed to provide design criteria for desensitizing the equipment on a cost effective basis. Author (GRA)

N73-28111# Clevite Corp., Palo Alto, Calif. Shockley Transistor Div.

COMPARISON OF ELECTRIC AND MAGNETIC COUPLING THROUGH BRAIDED-WIRE SHIELDS Technical Report, Jul. 1971 - Feb. 1972

E. F. Vance May 1973 50 p refs

(Contract F29601-69-C-0127; AF Proj. 133B)

(AD-761823; AFWL-TR-73-71) Avail: NTIS CSCL 09/1

The effect of coupling through braided-wire or other leaky shields by means of electric-field penetration through the holes in the shield is examined for the loose-coupling case. The electric coupling is compared to the magnetic coupling, and it is shown that the electric and magnetic coupling terms are proportional to the electric and magnetic polarizabilities of the holes in the shield. Inclusion of the electric coupling changes the coupling through typical braided shields by less than a factor of two, but it adds a directional effect to the coupling. Author (GRA)

N73-28112# Army Foreign Science and Technology Center, Charlottesville, Va.
VARIABLE LENGTH PULSE SHAPER
V. S. Rakityanskii 16 Mar. 1973 4 p Transl. into ENGLISH of Russian Patent no. 198393 2 p
(AD-762328; FSTC-HT-23-1726-72) Avail: NTIS CSCL 14/2

Familiar transistorized, variable-length pulse shapers have triggers with emitter couplings and amplifying stages. The proposed shaper differs in that the transistorized commutators of the triggers are connected to the base of a transistorized amplifying stage through a sequence of connected, time-allotting capacitors and diodes. The latter are directly connected to the discharge circuit of the capacitors and variable resistors are connected to the circuit for charging them. This feature of the system ensures the shaping of negative pulses, the length of which changes in relation to changes in frequency of triggering heteropolar pulses. GRA

N73-28113# IIT Research Inst., Chicago, Ill. Reliability Analysis Center.
MICROCIRCUIT DEVICE ENVIRONMENTAL DATA
Irvin L. Krulac Apr. 1973 268 p
(Contract F30602-73-C-0065)
(AD-761951; RAC-MDED-0473) Avail: NTIS CSCL 09/5

The tabulation contains environmental test results which are organized and presented by device manufacturer and part numbers. It provides, for each entry, a description of the device function, technology, package type, screen level and manufacturing data (date code), in addition to the applied environmental conditions. Percent defective statistics and failure modes/mechanisms are reported. The compendium is updated in its entirety and reissued annually. Author (GRA)

N73-28114# Utah Univ., Salt Lake City. Computer Science Div.
AUTOMATIC PRINTED CIRCUIT BOARD DESIGN
Donald Oestreicher Jun. 1972 128 p refs Sponsored in part by ARPA
(Contract F30602-70-C-0300)
(AD-762021; UTEC-CSC-72-119) Avail: NTIS CSCL 09/5

The report describes a new apporach to the automatic design of printed circuit boards. In the past, the problem has been partitioned by design functions. The generally recognized functions are pin assignment, component placement, and wire routing or layout. This is essentially a serial partition of the problem. Instead of producing the layout wire by wire, as is currently the rule, the layout is produced by traversing the board in a raster scan fashion, routing all relevant wires in parallel. This allows all design functions to be accomplished simultaneously. The fact that the layout functions are done concurrently provides for greater feedback between the different functions, and therefore greater efficiency, as more relevant information is available to each function. (Modified Author Abstract) GRA

N73-28115# General Dynamics/Pomona, Calif.
STUDY AND INVESTIGATION OF BEACON SOLID STATE RF SOURCE, VOLUME 1 Final Technical Report, Apr. 1971 - Sep. 1972
L. J. Lader, J. B. Winderman, and G. N. Hulderman Apr. 1973 92 p refs
(Contract F30602-71-C-0225; AF Proj. 5556)
(AD-761525; TM6-125/AT-144-Vol-1; RADC-TR-73-100-Vol-1) Avail: NTIS CSCL 17/7

The feasibility of generating one killowatt of microwave pulse power in a compact efficient package was explored for application in all-solid-state avionics. Since the duty factor of these transmitters is relatively low, a rational approach to the generation of high peak power from otherwise limited power transistors, is to combine them in a circuit which converts their modest CW power into high peak power at low duty factor. This is accomplished by use of the Inverse Fourier Transform method in which a number of low power CW spectral components are combined to form pulses. Calculations show that eight 25-watt CW lines will produce 1600 watts of pulse power. A compact model was fabricated to show the feasibility of the IFT method. A fundamental difficulty was encountered in the design of the power combiner of the eight spectral lines. Severe test and evaluation problems resulted from low reliability transistors. In order to solve the fundamental difficulty a new class of power combiner must be developed which employs a high Q filter for each spectral line before summation to produce the high peak power pulses. Author (GRA)

N73-28116# General Dynamics/Pomona, Calif.
STUDY AND INVESTIGATION OF BEACON SOLID RF SOURCE. VOLUME 2: APPLICATION OF THE INVERSE FOURIER TRANSFORM METHOD OF PRODUCING HIGH PEAK POWER Final Technical Report, Apr. 1971 - Sep. 1972
L. J. Lader, J. B. Wunderman, and G. N. Hulderman Apr. 1973 38 p refs
(Contract F30602-71-C-0225; AF Proj. 5556)
(AD-761526; TM6-125/AT-144-Vol-2; RADC-TR-73-100-Vol-2) Avail: NTIS CSCL 17/7

A number of applications of the Inverse Fourier Transform Method of producing high peak power, including digital coding and expendable jamming, is described. The rationale for the use of the IFT method, its bounds, constraints, limitations, and rqles, and design rules are included. Also, the preliminary designs of an expendable jammer and a filter combiner are given. Author (GRA)

N73-28117# ITT Electron Tube Div., Fort Wayne, Ind.
PATTERN THRESHOLD RECOGNITION DEVICE Final Report, 1 May 1971 - 31 Aug. 1972
S. Nevin and L. G. Wolfgang May 1973 76 p
(Contract DAAB07-71-C-0226)
(AD-762164; ECOM-0226-F-71) Avail: NTIS CSCL 09/1

The purpose of this contract is to develop further the pattern threshold recognition device by studying and improving its electron optics and target. To make the device more practical, processing techniques for obtaining usable operating lifetimes were developed. To assist in the study of the device's electron-optics and target performance, a demountable electron-optical bench was built. Lifetime improvement was verified in test tubes. Both improved tube design and the better processing schedules were incorporated into the final sample tubes. Author (GRA)

N73-28118# McDonnell Douglas Electronics Co., St. Charles, Mo.
SOLID STATE HIGH POWER AMPLIFIER FOR UHF Semiannual Report, 3 Jul. 1972 - 3 Jan. 1973
Quentin F. Veit, John S. Brodkowicz, Frank D. Hockett, John H. Johnson, and James L. House Jan. 1973 230 p refs
(Contract DAAB07-72-C-0335; DA Proj. 1S6-62071-A-448)
(AD-762175; ECOM-0335-1-72) Avail: NTIS CSCL 09/5

The report describes the effort expended to data on a program to develop a UHF broadband power amplifier. The distinguishing characteristics of the amplifier are an overall power gain of 10 db, an output power of 250 watts CW, and a frequency range of 620 to 960 MHz. This report discusses the preliminary design analysis and the resulting necessary design goals to realize the amplifier design. In addition, the results of experimental component evaluation and feasibility studies are included. Author (GRA)

N73-28119# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SEMICONDUCTOR INTEGRATED CIRCUITS OF CONVERTERS OF NONELECTRIC VALUES INTO ELECTRICAL
B. V. Malin and K. M. Ponomarev 9 May 1973 23 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radioelektron. (USSR), v. 14, no. 11, 1971 p 1319-1329
(AD-762312; FTD-MT-24-1797-72) Avail: NTIS CSCL 09/5

The report briefly discusses microcircuits which record optical radiation, mechanical stresses, and magnetic fields. GRA

N73-28120# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYBRID NEURISTOR LINES BASED ON P-N-P-N-S STRUCTURES
G. F. Belova, V. N. Gorokhov, V. A. Kuzmin, and Q. R. Mochalkin 16 May 1973 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Radioelektron. (USSR), v. 14, no. 11, 1971 p 1312-1318
(AD-76231.1; FTD-MT-24-1796-72) Avail: NTIS CSCL 09/1

A description is given of the development and study of hybrid

neuristor lines of two forms: with the coupling between the elements on two common base regions and on one common base. The basic electrical characteristics depending on structure, values of the passive elements and operating mode of the neuristors are measured. Author (GRA)

N73-28121# Army Foreign Science and Technology Center, Charlottesville, Va.
THE TECHNICAL AND ECONOMICAL EFFICIENCY OF A THERMIONIC CATHODE
A. I. Vishnevskii 26 Dec. 1972 5 p refs Transl. into ENGLISH from Vestn. Politekhn. Inst., Seriya Radiotekhn. (Kiev), no. 7, 1970 p 3-5
(AD-761535; FSTC-HT-23-1087-72) Avail: NTIS CSCL 09/1

A mathematical formula is presented to determine the technical and economic efficiency of thermoionic cathodes. GRA

N73-28122# Honeywell, Inc., Lexington, Mass.
MERCURY CADMIUM TELLURIDE 10.6-MICRON PHOTODIODE Semiannual Report, 15 Nov. 1971 - 15 Jul. 1972
Donald A. Soderman and T. Koehler Mar. 1973 87 p refs (Contract DAAB07-71-C-0236; DA Proj. 1H6-62705-A-056)
(AD-762167; ECOM-0236-2-71) Avail: NTIS CSCL 09/1

Improvements have been made in the mercury diffusion fabrication process technology required for sensitive, high speed n on p mercury-cadmium-telluride (Hg,Cd)Te photodiode detectors that operate at 77K. Effort has been directed toward the investigation of surface p- doping, zinc sulfide (ZnS) coating, diffusion masking, ion implantation, bulk material evaluation and annealing. An analysis of transit time effects has shown that p-type (Hg,Cd)Te substrate material produces diodes with frzquency response a factor of 50 better than n-type (Hg,Cd)Te. Therefore, the prime approach for high frequency diodes will pursue n on p structures. Other selection criteria for substrate material have been determined as crystal perfection, 10 to the 17th power holes/cc p-type with low donor concentration, and minority carrier diffusion length greater than 10 microns. successful results at surface passivation have been made with surface doping and ZnS coatings. (Modified Author Abstract) GRA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N73-28123*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUPERSONIC AERODYNAMIC CHARACTERISTICS OF THE NORTH AMERICAN ROCKWELL ATP SHUTTLE ORBITER
George M. Ware, Bernard Pencer, Jr., and Roger H. Founier Washington Aug. 1973 35 p refs
(NASA-TM-X-2804; L-8840) Avail: NTIS HC $3.00 CSCL 01C

A wind tunnel study to determine the supersonic aerodynamic characteristics of a 0.01925-scale model of the space shuttle orbiter configuration is reported. The model consisted of a low-finess-ratio body with a blended 50 swept delta wing forming an ogee planform and a center-line-mounted vertical tail. Tests were made at Mach numbers from 1.90 to 4.63, at angles of attack from -6 to 30, at angles of sideslip of 0 and 3, and at a Reynolds number, based on body length, of 5.3x 1 million. Author

N73-28124*# Stanford Research Inst., Menlo Park, Calif.
FERRITE LOGIC RELIABILITY STUDY Final Report
James A. Baer and C. Bruce Clark Jul. 1973 99 p refs
(Contract NAS1-11453; SRI Proj. 1832)
(NASA-CR-132265) Avail: NTIS HC $7.00 CSCL 09C

Development and use of digital circuits called all-magnetic logic are reported. In these circuits the magnetic elements and their windings comprise the active circuit devices in the logic portion of a system. The ferrite logic device belongs to the all-magnetic class of logic circuits. The FLO device is novel in that it makes use of a dual or bimaterial ferrite composition in one physical ceramic body. This bimaterial feature, coupled with its potential for relatively high speed operation, makes it attractive for high reliability applications. (Maximum speed of operation approximately 50 kHz.) Author

N73-28125# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONICS IN THE ANTI-AIR DEFENSE SYSTEM
H. Malohodzic 10 May 1973 23 p Transl. into ENGLISH from Vazduhoplovni Glasnik (Yugoslavia), v. 15, no. 6, 1958 p 719-728
(AD-761540; FTD-HC-23-625-72) Avail: NTIS CSCL 15/3

The report contains a generalized description of antiaircraft defense systems and procedures as used by Communist-bloc countries. Mention is made of defense system components employed in the United States. GRA

N73-28126# Lincoln Lab., Mass. Inst. of Tech., Lexington.
POWER LOSS RELATIONSHIPS FOR TWO BASIC COUPLED RESONATOR CIRCUITS
Joseph C. Lee 29 May 1973 17 p refs
(Contract F19628-73-C-0002; AF Proj. 649L)
(AD-762252; TN-1973-22; ESD-TR-73-163) Avail: NTIS CSCL 09/5

The symmetrically coupled transmission and reaction resonator circuits are analyzed through lumped RLC constant equivalent circuits and the transmission, relfection and dissipation characteristics are expressed in terms of loaded to unloaded Q ratio Q sub L/Q sub o. The return losses of reaction and transmission resonator circuits have the same expressions in terms of Q sub L/Q sub o as the insertion loss of transmission and reaction resonator circuits, respectively, and the dissipation loss referred to the incident power is identical for the two basic coupling circuits. Author (GRA)

N73-28127# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DEVELOPMENTAL TENDENCIES OF INTEGRATED MAGNETIC CIRCUITS
Yu. A. Popov and I. F. Babalova 25 May 1973 28 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (USSR), v. 14, no. 11, 1971 p 1291-1303
(AF Proj. 5519)
(AD-762267; FTD-MT-24-1795-72) Avail: NTIS CSCL 09/5

The basic trends of development of integrated magnetic circuits are examined. Questions of the construction of circuits with branched cores which use the principle of balanced current distribution, questions of the construction of logic circuits on thin magnetic films, and also principles of the construction of magnetic logic and memory units on the basis of controlled domains in solid-state structures manufactured by the method of group integral technology are examined. The prospects for the development of magnetic microelectronics on the basis of the production of functional instruments which fulfill required functions with a lower number of local heterogeneities than in semiconductor integrated circuits which use principles of element integration are discussed. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N73-28128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRODUCTION OF I-123 Patent Application
James W. Blue, inventor (to NASA) Filed 17 Jul. 1973 12 p (NASA-Case-LEW-11390-3; US-Patent-Appl-SN-380046) Avail: NTIS HC $3.00 CSCL 14B

The production of I-123 from cesium bombardment by high energy protons in a heat pipe is examined. A spallation reaction

produces Xe-123 and many other radioactive contaminants which pass from the heat pipe to low temperature traps where undesirable contaminants are removed. Xenon is held for a period of time sufficient for it to decay into I-123. NASA

N73-28129# Mitre Corp., McLean, Va.
REDUCTION OF PARALLEL RUNWAY REQUIREMENTS Final Report
Andrew L. Haines Jan. 1973 58 p refs
(Contract DOT-FA70WA-2448)
(MTR-6282; FAA-EM-73-9) Avail: NTIS HC $5.00

Results and recommendations are presented concerning the relaxation of spacing requirements for independent IFR parallel approaches into closely spaced runways. All results presented were derived by analyzing what system design or performance changes are required (either airborne or ground based) so as to result in safety equal to the current system's, but at closer spacing. A set of system changes and improvements are specified which, based on analysis, will permit closer runway spacing. Author

N73-28130*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GLOBAL STATION COORDINATE SOLUTION BASED UPON CAMERA AND LASER DATA - GSFC 1973
J. G. Marsh, B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.), and S. M. Klosko (Wolf Res. and Develop. Corp., Riverdale, Md.) May 1973 71 p refs Presented at the 1st Intern. Symp. on the Use of Artificial Satellites for Geodesy and Geodyn., Athens, 14-21 May 1973
(NASA-TM-X-70422; X-592-73-171) Avail: NTIS HC $5.75 CSCL 14B

Results for the geocentric coordinates of 72 globally distributed satellite tracking stations consisting of 58 cameras and 14 lasers are presented. The observational data for this solution consists of over 65,000 optical observations and more than 350 laser passes recorded during the National Geodetic Satellite Program, the 1968 Centre National d'Etudes Spatiales/ Smithsonian Astrophysical Observatory (SAO) Program, and International Satellite Geodesy Experiment Program. Dynamic methods were used. The data were analyzed with the GSFC GEM and SAO 1969 Standard Earth Gravity Models. The recent value of GM = 398600.8 cu km/sec square derived at the Jet Propulsion Laboratory (JPL) gave the best results for this combination laser/optical solution. Solutions are made with the deep space solution of JPL (LS-25 solution) including results obtained at GSFC from Mariner-9 Unified B-Band tracking. Datum transformation parameters relating North America, Europe, South America, and Australia are given, enabling the positions of some 200 other tracking stations to be placed in the geocentric system. Author

N73-28131# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
SUPERCONDUCTING PULSED MAGNET SYSTEMS FOR HIGH ENERGY SYNCHROTRONS
W. Heinz Jun. 1972 39 p refs Presented at the 4th Intern. Cryog. Eng. Conf., Eindhoven, Netherlands, 24-26 May 1972
(Conf-720565-2) Avail: AEC Depository Libraries HC $4.00

Superconductivity is getting more and more important for future accelerators or for improving existing ones. The higher magnetic fields attainable allow an increase in energy by a factor of 3 to 4 when geometry is kept constant. Especially attractive is the possibility to convert an existing proton synchrotron to higher energies by replacing conventional iron magnets with superconducting ones. Therefore, pulsed superconducting magnets which meet all the requirements of a synchrotron magnet have to be developed with the necessary cryogenic facility. Problems, state of the art and experience with conductors, magnets and cryostats are discussed. Author

N73-28132# Fiat S.p.A., Turin (Italy).
A FEASIBILITY STUDY FOR A THREE-AXIS FACILITY FOR THE SIMULATION OF A SATELLITE ATTITUDE-CONTROL SYSTEM
E. BeBernardis, M. Berger, P. Conti, G. C. Ferrero, and A. Santinelli Paris ESRO Nov. 1972 238 p refs
(Contract ESTEC-1180/70)
(ESRO-CR-61) Avail: NTIS HC $14.00

The feasibility of a three-axes motion simulator for satellite attitude control systems was studied. The purpose of the simulation and the requirements of the motion simulator are discussed and the proposed facility described. The various subsystems such as the measuring and support platform, computer, and drive system, are considered. The applicability of the facility for different test levels is discussed and the general capabilities, qualities and restrictions noted. ESRO

N73-28133# Gesellschaft fuer Weltraumforschung m.b.H., Porz (West Germany).
FACILITIES FOR SPACE PROJECTS: VOLUME 1: FACILITIES FOR ENVIRONMENTAL TESTS [ANLAGEN FUER RAUMFLUGPROJEKTE. BAND 1: ANLAGEN ZUR UMWELTERPROBUNG]
Oct. 1972 174 p In GERMAN
Avail: NTIS HC $10.75

A survey is presented of German test facilities for environment simulation. All the characteristic dimensions and performance data of available facilities and equipment are summarized. The equipment was subdivided into six categories: space environment simulation, electromagnetic measurements, temperature and climatic testing, dynamic tests, physical measurements, and data collection and processing. ESRO

N73-28134# Washington Univ., Seattle. Aerospace Research Lab.
THE LASER HEATED HYPERSONIC WIND TUNNEL Interim Technical Report, Aug. 1971 - Jul. 1972
Victor R. Buonadonna, Charles J. Knight, and Abraham Hertzberg May 1972 37 p refs
(Contract F33615-71-C-1914; AF Proj. 7065)
(AD-761506; ARL-73-0074) Avail: NTIS CSCL 14/2

A preliminary analytic feasibility study has been made concerning the addition of stagnation enthalpy to the air flow of a hypersonic wind tunnel by volume energy addition using a high power (megawatts) CO2 laser. A model has been formulated on the basis of quasi one-dimensional, steady flow in a Laval nozzle with a collimated laser beam propagating in the downstream direction. Stagnation conditions on the order of 10,000K at 1,000 atm. are possible with 10% head losses. Heat transfer rate at the throat (50 k Watts/square centimeter) is the major limiting factor to successful operation. Author (GRA)

N73-28135# Naval Postgraduate School, Monterey, Calif.
ESTIMATION OF A COST FUNCTION FOR A NAVAL AIR REWORK FACILITY M.S. Thesis
W. C. Trafton Mar. 1973 76 p refs
(AD-761475) Avail: NTIS CSCL 15/5

The objective of the study was to estimate a cost function from a Constant Elasticity of Substitution production function and a Cobb-Douglas production function for the aircraft rework and engine repair programs at the Naval Air Rework Facility, North Island, San Diego, California. The cost functions were estimated by multiple regression analysis from data aggregated from actual data taken from production records of the two programs. An attempt was made to validate the two cost functions that were obtained, and a methodology was outlined for comparing predicted costs to actual production costs at the Naval Air Rework Facility. Author (GRA)

N73-28136# Naval Ship Research and Development Center, Bethesda, Md.
DEEP SEA SIMULATION FACILITIES: PRESENT STATUS 1972
Ralph B. Allnutt Sep. 1972 55 p refs
(AD-761899; NSRDC-3825) Avail: NTIS CSCL 14/2

The report lists the deep sea simulation facilities presently available in the United States. It indicates the possible needs for additional facilities and gives some insight into the conditions that require updating of existing facilities. Background material on types and frequencies of failures will be helpful to those concerned with design and certification. Author (GRA)

N73-28137# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION AND MAINTENANCE OF EXPEDIENT-SURFACED AIRFIELD FACILITIES Final Report

Philip J. Vedros, Jr. May 1973 28 p refs
(AD-762126; AEWES-Instruction-S-73-1) Avail: NTIS CSCL 01/5

The instruction report presents a reference of suggested guidelines on the evaluation and maintenance of expedient-surfaced airfield facilities. The expedient surfacing materials covered in this discussion are aluminum and steel landing mats and a neoprene-coated nylon membrane. Methods of repair that have performed satisfactorily for the landing mats and T17 membrane are presented. Author (GRA)

N73-28138# Army Foreign Science and Technology Center, Charlottesville, Va.
STABILITY OF TWO-COORDINATE AUTOMATIC TRACKING SYSTZMS
A. I. Kobrin and I. V. Novozhilov 8 Mar. 1973 6 p refs Transl. into ENGLISH from Analiz i Sinitez Sistem Avtomatich. Uprav. (Moscow), 1968 p 382-383
(AD-762106; FSTC-HT-23-1310-72) Avail: NTIS CSCL 17/8

The stability of two-coordinate systems of angle tracking-systems are studied using differential equations. Dead center solutions of the system and the range of stability of both linear and nonlinear three channel systems are investigated. E.H.W.

N73-28139# ARO, Inc., Arnold Air Force Station, Tenn.
A DESCRIPTION OF A FORCED-OSCILLATION TEST MECHANISM FOR MEASURING DYNAMIC-STABILITY DERIVATIVES IN ROLL Final Report
G. E. Burt Jun. 1973 36 p refs
(ARO Proj. VA017; ARO Proj. VA206)
(AD-762258; ARO-VKF-TR-72-211) Avail: NTIS CSCL 14/2

A description is given of a forced-oscillation, dynamic-stability test mechanism for measuring the moments and forces due to roll velocity on lifting configurations. The mechanism can support models with a combined loading of up to 1200 pounds of normal force and 300 pounds of axial force and is water-cooled to permit testing in hypersonic tunnels. Bench tests were conducted using a magnetic calibrator, which indicated that the mechanism could precisely measure the rolling moment, yawing moment, and side force due to roll velocity. Wind tunnel tests were conducted on an AGARD Model B at Mach numbers of 2, 3, and 4 and at angles of attack from -4 to 11 deg to verify the design. (Modified Author Abstract) GRA

N73-28140# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-INTENSITY PROTON ACCELERATOR
E. A. Abramyan and V. V. Vecheslavov 6 Jun. 1973 11 p refs Transl. into ENGLISH from Tr. Vses. Soveshch. Uskor. Zaryazhennykh Chastits (Moscow), no. 2, 1970
(AD-762240; FTD-HT-23-600-73) Avail: NTIS CSCL 20/7

The report discusses the design of proton accelerators. GRA

N73-28141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COLLECTIVE CYCLIC ACCELERATOR: THE GYROTRON
A. A. Kolomenokii 5 Jun. 1973 34 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSR, Fiz. Inst. (Moscow), no. 141, 1972 p 1-31
(AD-762309; FTD-HT-23-338-73) Avail: NTIS CSCL 20/7

The following topics are discussed: Rotating Electromagnetic Field of a Cylindrical Resonator; Movement of the Electron in the Field of Wave H(112); Movement of an Ion Captured in the Potential Well of the Electron Beam; Certain Problems Involved in the Interaction of the Particles in the Beam. GRA

N73-28142# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
EVALUATION OF THE SOLID STATE SIMULATOR FOR THE A-7B AIRCRAFT ELECTRICAL SYSTEM Technical Report, Oct. 1970 - Jun. 1972
Glenn M. Kevern Apr. 1973 151 p refs
(AF Proj. 3145)
(AD-762295; AFAPL-TR-72-88) Avail: NTIS CSCL 01/3

The report describes the program for comparative evaluation of conventional and solid state A-7B aircraft electrical system simulators to determine advantages, find and correct deficiencies, and thereby guide research and development which will result in application of solid state technology to AF aircraft, providing significant improvements in weight, reliability, wiring simplification, power quality, and electrical system flexibility. (Modified Author Abstract) GRA

N73-28143# ARO, Inc., Arnold Air Force Station, Tenn.
A DESCRIPTION OF A PITCH/YAW DYNAMIC STABILITY, FORCED-OSCILLATION TEST MECHANISM FOR TESTING LIFTING CONFIGURATIONS Final Report
G. E. Burt AEDC Jun. 1973 38 p refs
(ARO Proj. VW5207)
(AD-762286; ARO-VKF-TR-73-16; AEDC-TR-73-60) Avail: NTIS CSCL 14/2

A forced-oscillation test mechanism for measuring the dynamic stability derivatives in pitch or yaw on lifitng configurations has been developed at AEDC-VKF. The mechanism will support models with a combined loading up to 1200-lb normal force and 300-lb axial force. Wind tunnel verification tests were conducted on AGARD Calibration Models B and C and Model B body alone at Mach numbers of 2.5, 3.0, 3.5, and 4.0 and at angles of attack from -4.5 to 11.5 deg. A description of the apparatus, testing technique, data reduction equations (including effects of sting bending), and the results from the laboratory bench and wind tunnel tests are included. The results of these tests were in good agreement with previous experimental data and theory. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N73-28144* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPARATUS AND METHOD FOR GENERATING LARGE MASS FLOW OF HIGH TEMPERATURE AIR AT HYPERSONIC SPEEDS Patent
Alexander P. Sabol and Roger B. Stewart, inventors (to NASA) Issued 10 Jul. 1973 5 p Filed 9 Mar. 1972 Supersedes N72-25307 (10 - 16, p 2140)
(NASA-Case-LAR-10612-1; US-Patent-3,744,305; US-Patent-Appl-SN-233173; US-Patent-Class-73-147) Avail: US Patent Office CSCL 20D

High temperature, high mass air flow and a high Reynolds number test air flow in the Mach number 8-10 regime of adequate test flow duration is attained by pressurizing a ceramic-lined storage tank with air to a pressure of about 100 to 200 atmospheres. The air is heated to temperatures of 7,000 to 8,000 R prior to introduction into the tank by passing the air over an electric arc heater means. The air cools to 5,500 to 6,000 R while in the tank. A decomposable gas such as nitrous oxide or a combustible gas such as propane is injected into the tank after pressurization and the heated pressurized air in the tank is rapidly released through a Mach number 8-10 nozzle. The injected gas medium upon contact with the heated pressurized air effects an exothermic reaction which maintains the pressure and temperature of the pressurized air during the rapid release. Official Gazette of the U.S. Patent Office

N73-28145 New York Univ., N.Y.
AN EXPERIMENTAL INVESTIGATION OF BOUNDARY LAYER TRANSITION OVER THREE AXIALLY SYMMETRIC BODY AT FREE STREAM MACH NUMBER 8.0 Ph.D. Thesis
Leonidas E. Sakell 1972 201 p
Avail: Univ. Microfilms Order No. 73-9083

An experimental investigation of the flow field over three axisymmetric bodies at various angles of attack is herein presented. The three bodies investigated were a ten degree half angle sharp nose cone, a 0.5 inch nose radius (10 half angle) blunt nose cone, and a 1.0 inch nose radius (10 half angle) blunt nose cone. Both the windward and leeward flow regions were investigated to determine boundary layer transition point

characteristics as a function of geometry, angle of attack, and freestream conditions. Boundary layer transition occured naturally over all models and was not artificially induced. Measured static pressure distributions were used with various theories to compare these theories with the experimental results obtained herein. In general, good agreement was obtained. The tests were conducted at a Mach number of six, with the stagnation pressure varied from one hundred to two thousand psia. The stagnation temperature was in the range of 800-870 R. The angles of attack considered were zero, two, four, eight, and twelve degrees for all the models tested. Dissert. Abstr.

N73-28146 Pennsylvania State Univ., University Park.
SOME PROBLEMS IN THE STABILITY OF FLOWS OF VISCOELASTIC FLUIDS Ph.D. Thesis
Pijush Kanti Kundu 1972 218 p
Avail: Univ. Microfilms Order No. 73-7454

Problems in the stability of flows of viscoelastic fluids are discussed. The case of plane Couette flow has been solved by the classical energy method of Orr. With disturbances in the form of streamwise vortices in a plane Couette flow of a second-order fluid, the sign of the Weissenberg effect has been shown to be crucial. Linear stability theory has been used to investigate the stability of two flows of the Oldroyd fluid. For both flows, the presence of elasticity has been found to destabilize the flow and the presence of elasticity has been found to destabilize the flow to increase the critical wave number. Dissert. Abstr.

N73-28147 Iowa State Univ. of Science and Technology, Ames.
NUMERICAL COMPUTATION OF THE HYPERSONIC RAREFIED FLOW PAST THE SHARP LEADING EDGE OF A FLAT PLATE Ph.D. Thesis
Robert Alan Mohling 1972 98 p
Avail: Univ. Microfilms Order No. 73-9465

The hypersonic rarefied flow near the sharp leading edge of a flat plate has been computed using a finite difference solution of the complete, unsteady Navier-Stokes equations. MacCormack's finite difference scheme was used to solve the Navier-Stokes equations. The solution is advanced in time from the initial conditions until the steady state solution is reached. The computational region extends from the free-stream ahead of the plate to the strong interaction regime. Both wall slip and temperature jump are included in the calculations. Comparisons have been made with experimental data, correlation formulas, and numerical results of the Monte Carlo simulation technique. The numerical results compare favorably in the strong interaction and merged layer regions but some deviations are noted in the transition and near-free molecule regions. However, the wall pressure does approach the free molecule limit as the leading edge is approached. Dissert. Abstr.

N73-28148 New York Univ., N.Y.
REACTING AND NONREACTING ANALYSIS OF SUPERSONIC VISCOUS FLOW Ph.D. Thesis
Robert Cavalleri 1972 178 p
Avail: Univ. Microfilms Order No. 73-9068

The analysis of a supersonic flow that involves a viscous and inviscid flow is theoretically analyzed using a unified solution technique. The analysis of a supersonic flow field is usually divided into two separate flow problems interrelated by the boundary conditions imposed on a selected boundary between the viscous and inviscid flow. There are flow problems such that this technique would yield incorrect modeling of the flow due to the high degree of coupling between the viscous and inviscid flow. The method of analysis presented herein termed viscous characteristics uses a unified approach to the solution of supersonic flow problems where the viscous and inviscid effects are of equal importance. The equations used are derived in detail and the assumptions inherent in the analysis are stated. Dissert. Abstr.

N73-28149 New York Univ., N.Y.
THREE DIMENSIONAL NOZZLE FLOW FIELDS BY A REFERENCE PLANE TECHNIQUE, INCLUDING THE EFFECT OF EQUILIBRIUM HYDROGEN-AIR CHEMISTRY Ph.D. Thesis
Paul D. DelGuidice 1972 250 p
Avail: NTIS Avail: Univ. Microfilms Order No. 73-9070

A numerical method employing reference plane characteristics has been developed for the calculation of geometrically complex three-dimensional nozzle-exhaust flow fields, heretofore uncalculable by existing methods. The nozzles may have irregular cross sections with swept throats and may be stacked in modules using the vehicle undersurface for additional expansion. The nozzles may have highly nonuniform entrance contitions, the medium considered being an equilibrium hydrogen-air mixture. The program calculates and carries along the underexpansion shock contact as discrete discontinuity surfaces, for a nonuniform vehicle external flow. A wide variety of geometric problems may be considered since the reference plane method has been developed for three separate coordinate systems, all incorporated into a single program. Dissert. Abstr.

N73-28150 New York Univ., N.Y.
INVESTIGATION OF PARTICLE SEEDING ON JET EXHAUST NOISE Ph.D. Thesis
Toyohiko Suzuki 1972 96 p
Avail: Univ. Microfilms Order No. 73-9088

The equations describing the motion of a string-like particle under shear motion of the ambient fluid are derived. These are extended to the equations of two phase continuum flow. The applications to jet noise reduction are given. The effect of the suspension of these particles in the fluid is described by parameters, mass distribution ratio, m sub o/m sub t, concentration of the particles, Rho sub o/Rho sub a, the ratio tau/tau sub s of the relaxation time which depends on the shape parameters of the particles and the characteristic shear frequency, Omega/omega, respectively. It is shown that under a certain choice of these parameters, the particles have an appreciable effect on sound transmission. Decay factor is computed as a function of the frequency of the sound for various values of parameters. Mass distribution ratio was found to be a very important parameter. Dissert. Abstr.

N73-28151 New York Univ., N.Y.
DIFFRACTION OF SHOCK WAVE BY A MOVING SLENDER BODY Ph.D. Thesis
Vin King Yang 1972 111 p
Avail: Univ. Microfilms Order No. 73-9092

An analytical solution is obtained for the disturbance pressure due to the impinging of a plane shock wave of arbitrary strength on a moving slender body. The body may move at subsonic or supersonic speed relative to the flow ahead of or behind the shock wave. The cross-sectional shape of the body is arbitrary. The symmetric part of the solution is obtained by first obtaining the solution for the diffraction of a shock wave by a moving axially symmetric body and then applying a slender body approximation. The anti-symmetric terms are obtained in a manner analogous to steady slender body theory. To illustrate the theory, the pressure distribution on the surface of a cone is presented for various combinations of angle of attack, shock strength and body speed. In addition results for the coefficients of lift and moment about the body tip and for the center of lift are obtained and applied to various slender body configurations.
Dissert. Abstr.

N73-28152 Notre Dame Univ., Ind.
A NEW PHENOMENOLOGICAL APPROACH TO THE TURBULENT SHEAR FLOWS Ph.D. Thesis
Yi Lin Chen 1973 107 p
Avail: Univ. Microfilms Order No. 73-8068

A general turbulent shear flow theory is developed applicable to both wall turbulent shear flow as well as the free turbulent shear flow. This theory is essentially based on the establishment of a rate equation for the Reynolds stress obtained from a simple dimensional analysis of the important flow characteristics. This equation, together with the mean equations of motion form a hyperbolic system. Numerical integrations by the method of characteristics have been employed to obtain detailed solutions. The present theory has been applied to various flow cases such as the turbulent boundary layer with various pressure gradients, the turbulent wake after a trailing edge as well as the flow near separation. Dissert. Abstr.

N73-28153*# National Bureau of Standards, Boulder, Colo.
CAVITATION IN LIQUID CRYOGENS. 3: OGIVES

J. Hord Washington NASA May 1973 244 p refs
(NASA Order C-39004-B)
(NASA-CR-2242) Avail: NTIS HC $14.25 CSCL 02D

Experimental results for three, scaled, quarter-caliber ogives are given. Both desinent and developed cavity data, using liquid hydrogen and liquid nitrogen, are reported. The desinent data do not exhibit a consistent ogive size effect, but the developed cavity data were consistently influenced by ogive size; B-factor increases with increasing ogive diameter. The developed cavity data indicated that stable thermodynamic equilibrium exists throughout the vaporous cavities. These data were correlated by using the extended theory derived in NASA-CR-2156 (volume II of this report series). The new correlating parameter MTWO, improves data correlation for the ogives, hydrofoil, and venturi and appears attractive for future predictive applications. The cavitation coefficient and equipment size effects are shown to vary with specific equipment-fluid combinations. A method of estimating cavitation coefficient from knowledge of the noncavitating pressure coefficient is suggested. Author

N73-28154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FREE TURBULENT SHEAR FLOWS. VOLUME 1: CONFERENCE PROCEEDINGS
Washington 1973 763 p refs Conf. held at Hampton, Va., 20-21 Jul. 1972
(NASA-SP-321) Avail: NTIS HC $9.00 CSCL 20D

Available prediction methods for free shear flows were confronted with a set of standardized data. The resulting computations together with the discussions and the reports of the conference committees are presented. For individual titles, see N73-28155 through N73-28173.

N73-28155* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF TURBULENT FREE MIXING: STATUS AND PROBLEMS
Dennis M. Bushnell *In its* Free Turbulent Shear Flows, Vol. 1 1973 p 1-10 refs (For availability see N73-28154 19-12)
CSCL 20D

An overview of turbulence closure methods is presented along with discussions concerning which method works where and which approaches deserve further development. A table is given which lists the various computational techniques together with their prime usage areas. In addition, free mixing phenomena which were not specifically included in the basic data considered for the conference are summarized. D.L.G.

N73-28156* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A CRITICAL REVIEW OF THE EXPERIMENTAL DATA FOR DEVELOPED FREE TURBULENT SHEAR LAYERS
Stanley F. Birch and James M. Eggers *In its* Free Turbulent Shear Flows, Vol. 1 1973 p 11-40 refs. (For availability see N73-28154 19-12)
CSCL 20D

Experimental shear layer data are reviewed and the results are compared to numerical predictions for three test cases. It was concluded from the study that many, if not most, of the apparent inconsistencies which exist in the interpretation of the experimental data for free shear layers result from confusing data taken in developed turbulent flows with those taken in transitional or developing flows. Other conclusions drawn from the study include the following: (1) The effects of Mach number are more uncertain primarily because of limited data and the absence of any turbulence measurements for supersonic shear layers. (2) The data available for heterogeneous shear layers are not sufficient to clearly establish the effect of density ratio on mixing rate. D.L.G.

N73-28157* National Center for Atmospheric Research, Boulder, Colo.
STATISTICAL TURBULENCE THEORY AND TURBULENCE PHENOMENOLOGY
J. R. Herring *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 41-66 refs Sponsored by NSF (For availability see N73-28154 19-12)
CSCL 20D

The application of deductive turbulence theory for validity determination of turbulence phenomenology at the level of second-order, single-point moments is considered. Particular emphasis is placed on the phenomenological formula relating the dissipation to the turbulence energy and the Rotta-type formula for the return to isotropy. Methods which deal directly with most or all the scales of motion explicitly are reviewed briefly. The statistical theory of turbulence is presented as an expansion about randomness. Two concepts are involved: (1) a modeling of the turbulence as nearly multipoint Gaussian, and (2) a simultaneous introduction of a generalized eddy viscosity operator. D.L.G.

N73-28158* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A RATIONAL APPROACH TO THE USE OF PRANDTL'S MIXING LENGTH MODEL IN FREE TURBULENT SHEAR FLOW CALCULATIONS
David H. Rudy and Dennis M. Bushnell *In its* Free Turbulent Shear Flows, Vol. 1 1973 p 67-137 refs (For availability see N73-28154 19-12)
CSCL 20D

Prandtl's basic mixing length model was used to compute 22 test cases on free turbulent shear flows. The calculations employed appropriate algebraic length scale equations and single values of mixing length constant for planar and axisymmetric flows, respectively. Good agreement with data was obtained except for flows, such as supersonic free shear layers, where large sustained sensitivity changes occur. The inability to predict the more gradual mixing in these flows is tentatively ascribed to the presence of a significant turbulence-induced transverse static pressure gradient which is neglected in conventional solution procedures. Some type of an equation for length scale development was found to be necessary for successful computation of highly nonsimilar flow regions such as jet or wake development from thick wall flows. Author

N73-28159* United Aircraft Corp., East Hartford, Conn. Research Labs.
A KINEMATIC EDDY VISCOSITY MODEL INCLUDING THE INFLUENCE OF DENSITY VARIATIONS AND PRETURBULENCE
Leonard S. Cohen *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 139-183 refs (For availability see N73-28154 19-12)
CSCL 20D

A model for the kinematic eddy viscosity was developed which accounts for the turbulence produced as a result of jet interactions between adjacent streams as well as the turbulence initially present in the streams. In order to describe the turbulence contribution from jet interaction, the eddy viscosity suggested by Prandtl was adopted, and a modification was introduced to account for the effect of density variation through the mixing layer. The form of the modification was ascertained from a study of the compressible turbulent boundary layer on a flat plate. A kinematic eddy viscosity relation which corresponds to the initial turbulence contribution was derived by employing arguments used by Prandtl in his mixing length hypothesis. The resulting expression for self-preserving flow is similar to that which describes the mixing of a submerged jet. Application of the model has led to analytical predictions which are in good agreement with available turbulent mixing experimental data. Author

N73-28160* Illinois Univ., Urbana.
ANALYSIS OF FREE TURBULENT SHEAR FLOWS BY NUMERICAL METHODS
H. H. Korst, W. L. Chow, R. F. Hurt (Bradley Univ.), R. A. White, and A. L. Addy *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 185-232 refs (For availability see N73-28154 19-12)
(Grants NSG-13-59; NGL-14-005-140)
CSCL 20D

Studies are described in which the effort was essentially directed to classes of problems where the phenomenologically interpreted effective transport coefficients could be absorbed by, and subsequently extracted from (by comparison with experimental data), appropriate coordinate transformations. The transformed system of differential equations could then be solved without

further specifications or assumptions by numerical integration procedures. An attempt was made to delineate different regimes for which specific eddy viscosity models could be formulated. In particular, this would account for the carryover of turbulence from attached boundary layers, the transitory adjustment, and the asymptotic behavior of initially disturbed mixing regions. Such models were subsequently used in seeking solutions for the prescribed two-dimensional test cases, yielding a better insight into overall aspects of the exchange mechanisms. Author

N73-28161* Aeronautical Research Associates of Princeton, Inc., N.J.

THE RELATIONSHIP BETWEEN EDDY-TRANSPORT AND SECOND-ORDER CLOSURE MODELS FOR STRATIFIED MEDIA AND FOR VORTICES

Coleman Dup. Donaldson *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 233-258 refs (For availability see N73-28154 19-12)
(Contracts NASw-1868; F44620-69-C-0089)
CSCL 20D

The question is considered of how complex a model should be used for the calculation of turbulent shear flows. At the present time there are models varying in complexity from very simple eddy-transport models to models in which all the equations for the nonzero second-order correlations are solved simultaneously with the equations for the mean variables. A discussion is presented of the relationship between these two models of turbulent shear flow. Two types of motion are discussed: first, turbulent shear flow in a stratified medium and, second, the motion in a turbulent line vortex. These two cases are instructive because in the first example eddy-transport methods have proven reasonably effective, whereas in the second, they have led to erroneous conclusions. It is not generally appreciated that the simplest form of eddy-transport theory can be derived from second-order closure models of turbulent flow by a suitably limiting process. This limiting process and the suitability of eddy-transport modeling for stratified media and line vortices are discussed. Author

N73-28162* Virginia Polytechnic Inst. and State Univ., Blacksburg.

FREE TURBULENT MIXING IN A COFLOWING STREAM

Joseph A. Schetz *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 259-275 refs Sponsored by NASA (For availability see N73-28154 19-12)
CSCL 20D

The major points are described of a turbulent transport model of the classical, gradient transport, eddy viscosity type. The relationship is discussed of the developed model to the Prandtl (jet mixing) model, the Schlichting (wake) model, and the Clauser (boundary layer) model. Limitations of the model and test cases are summarized. D.L.G.

N73-28163* Bell Aerospace Co., Buffalo, N.Y.

PREDICTIONS OF AXISYMMETRIC FREE TURBULENT SHEAR FLOWS USING A GENERALIZED EDDY-VISCOSITY APPROACH

J. H. Morgenthaler *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 277-326 refs (For availability see N73-28154 19-12)
(Contract F44620-70-C-0016)
CSCL 20D

The generalized eddy viscosity approach is described and results are presented of test cases which show that predictions obtained by this approach are adequate for most engineering applications. Because of the importance of starting computations from the injection station where experimentally determined mean and turbulence parameters are rarely available, a very simple core model applicable to simple step-type (slug) profiles was developed. Agreement between predicted and experimental mean profiles was generally almost as good for calculations made by using this model throughout the core region and the transition model for all subsequent regions as predictions made by starting from experimental profiles in the transition region. The generalized eddy-viscosity model, which was developed in part through correlation of turbulence parameters, successfully predicted turbulent shear stress, turbuelnt intensity, and mean velocity profiles for a 0.040-inch-diameter microjet. Therefore, successful scaling by the model was demonstrated since data used in its development was for jet areas up to 90,000 times as large as the microjet and velocities only 1/20th as high. Author

N73-28164* New York Univ., N.Y.

PREDICTION AND EVALUATION OF EDDY-VISCOSITY MODELS FOR FREE MIXING

V. Zakkay, R. Sinha, and S. Normura *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 327-360 refs (For availability see N73-28154 19-12)
(Contract F33615-68-C-1184)
CSCL 20D

Analysis for the turbulent mixing of free jzts is presented in this paper and compared to recent experimental results. A turbulent mass diffusion model is presented and is based on the concentration potential core. The model yielded good results when compared with the experimental results except for low-speed flows where few experimental data are available. A review of recent experimental results verifies again that the three diffusion processes in turbulent mixing are interrelated; However, no single diffusion model may be used for all three processes. This is especially true when pressure gradients are present in the flow field. It is shown that even though momentum diffusion is significantly affected by pressure gradients, mass diffusion is not. It is further indicated that the mass diffusion model has been derived and is based on the accurate correlations of experimental results obtained for the concentration potential core. Similar techniques may be used in deriving an expression for the momentum and thermal diffusion coefficients. These expressions would be more complicated since they would have to take care of the boundary layer at the start of the mixing region. Finally, a comparison of the analyses, using this particular model and Ferri's model, with available experimental results is made. Author

N73-28165* Imperial Coll. of Science and Technology, London (England).

PREDICTION OF FREE SHEAR FLOWS: A COMPARISON OF THE PERFORMANCE OF SIX TURBULENCE MODELS

B. E. Launder, A. Morse, W. Rodi, and D. B. Spalding *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 361-426 refs (For availability see N73-28154 19-12)
CSCL 20D

The performance is evaluated of three distinct classes of turbulence model. These classes are: (1) Turbulent-viscosity models in which the length scale of turbulence is found by way of algebraic formulas, (2) turbulent-viscosity models in which the length scale of turbulence is found from a partial differential equation of transport, and (3) models in which the shear stress itself is the dependent variable of a partial differential conservation equation. Two models were examined in each class; thus, six different models were tested. A complete mathematical statement of these models is provided and a brief commentary on the models is included. Author

N73-28166* California Univ., San Diego.

A PROVISIONAL ANALYSIS OF TWO-DIMENSIONAL TURBULENT MIXING WITH VARIABLE DENSITY

Paul A. Libby *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 427-462 refs (For availability see N73-28154 19-12)
CSCL 20D

A predictive method for the titled flows based on the Prandtl energy method was developed and assessed by comparing predicted results with experimental results. For constant-density flows, both gross properties such as spreading rate and maximum turbulent kinetic energy and detailed properties such as mean shear stress distributions are shown to be well predicted. For variable-density flows, considerable attention is devoted to the inclusion in the analysis of the added effect of pressure fluctuations and of the variation in the several extant empirical parameters on the turbulent kinetic energy. It is found that a variation with Mach number of the characteristic Reynolds number for turbulent transport is needed to account for the observed decrease in spreading rate. The predictions which result from these considerations are compared with the limited experimental data presently available for the two crucial cases: compressible adiabatic mixing and low-speed isothermal mixing of two dissimilar gases. Author

N73-28167* ARO, Inc., Arnold Air Force Station, Tenn.
PREDICTION OF FREE TURBULENT MIXING USING A TURBULENT KINETIC ENERGY METHOD
Philip T. Harsha *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 463-521 refs (For availability see N73-28154 19-12)
(Contract F40600-72-C-0003; AF Proj. 9711)
CSCL 20D

Free turbulent mixing of two-dimensional and axisymmetric one- and two-stream flows is analyzed by a relatively simple turbulent kinetic energy method. This method incorporates a linear relationship between the turbulent shear and the turbulent kinetic energy and an algebraic relationship for the length scale appearing in the turbulent kinetic energy equation. Good results are obtained for a wide variety of flows. The technique is shown to be especially applicable to flows with heat and mass transfer, for which nonunity Prandtl and Schmidt numbers may be assumed.
Author

N73-28168* Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
A LOCAL EDDY VISCOSITY MODEL FOR TURBULENT SHEAR FLOW
Paul J. Ortwerth, Douglas C. Rabe, and Donald P. McErlean *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 529-547 refs (For availability see N73-28154 19-12)
CSCL 20D

In the model described, the eddy viscosity is assumed to be a fluid property dependent on the state of the fluid locally, namely the local density, turbulent kinetic energy, turbulence scale, and Mach number. An empirical law was found which related eddy viscosity to these properties satisfactorily for free jets. This law is used without modification for a set of test cases in free shear layers, free-jet decay, coaxial mixing, and wakes. The scale of turbulence is taken as a constant at any axial location equal to the width of the shear layer. By utilizing the boundary-layer order-of-magnitude analysis, a coupled set of fluid dynamic equations is formulated, which of necessity includes the equation for the production of turbulent kinetic energy.
Author

N73-28169* Illinois Inst. of Tech., Chicago.
TURBULENT KINETIC ENERGY EQUATION AND FREE MIXING
Thomas Morel, T. Paul Torda, and Peter Bradshaw (Imperial Coll. of Sci. and Technol.) *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 549-575 refs (For availability see N73-28154 19-12)
(Grant NGR-14-004-028)
CSCL 20D

Calculation of free shear flows was carried out to investigate the usefulness of several concepts which were previously successfully applied to wall flows. The method belongs to the class of differential approaches. The turbulence is taken into account by the introduction of one additional partial differential equation, the transport equation for the turbulent shear stress. The structure of turbulence is modeled after Bradshaw et al. This model was used successfully in boundary layers and its applicability to other flows is demonstrated. The work reported differs substantially from that of an earlier attempt to use this approach for calculation of free flows. The most important difference is that the region around the center line is treated by invoking the interaction hypothesis (concerning the structure of turbulence in the regions separated by the velocity extrema). The compressibility effects on shear layer spreading at low and moderate Mach numbers were investigated. In the absence of detailed experiments in free flows, the evidence from boundary layers that at low Mach numbers the structure of turbulence is unaffected by the compressibility was relied on. The present model was tested over a range of self-preserving and developing flows including pressure gradients using identical empirical input. The dependence of the structure of turbulence on the spreading rate of the shear layer was established.
Author

N73-28170* ARO, Inc., Arnold Air Force Station, Tenn.
AN INTEGRAL TURBULENT KINETIC ENERGY ANALYSIS OF FREE SHEAR FLOWS
C. E. Peters and W. J. Phares *In* NASA. Langley res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 577-628 refs (For availability see N73-28154 19-12)
(Contract F40600-72-C-0003; AF Proj. 9711)
CSCL 20D

Mixing of coaxial streams is analyzed by application of integral techniques. An integrated turbulent kinetic energy (TKE) equation is solved simultaneously with the integral equations for the mean flow. Normalized TKE profile shapes are obtained from incompressible jet and shear layer experiments and are assumed to be applicable to all free turbulent flows. The shear stress at the midpoint of the mixing zone is assumed to be directly proportional to the local TKE, and dissipation is treated with a generalization of the model developed for isotropic turbulence. Although the analysis was developed for ducted flows, constant-pressure flows were approximated with the duct much larger than the jet. The axisymmetric flows under consideration were predicted with reasonable accuracy. Fairly good results were also obtained for the fully developed two-dimensional shear layers, which were computed as thin layers at the boundary of a large circular jet.
Author

N73-28171* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPEN FORUM
In its Free Turbulent Shear Flows, Vol. 1 1973 p 629-652 refs (For availability see N73-28154 19-12)
CSCL 20D

Some experiments on turbulent free shear layers in pressure gradients are discussed. Topics covered in the discussion include: (1) two dimensional vortex structures, (2) the effect of channel walls, and (3) the case of a mixing layer in pressure gradient.
D.L.G.

N73-28172* Stanford Univ., Calif.
EXPERIMENTS IN FREE SHEAR FLOWS: STATUS AND NEEDS FOR THE FUTURE
S. J. Kline, D. E. Coles (Calif. Inst. of Technol.), J. M. Eggers (NASA. Langley Res. Center), and P. T. Harsha (ARO, Inc.) *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 655-672 refs (For availability see N73-28154 19-12)
CSCL 20D

Experiments in free turbulent flows are recommended with the primary concern placed on classical flows in order to augment understanding and for model building. Five classes of experiments dealing with classical free turbulent flows are outlined and proposed as being of particular significance for the near future. These classes include the following: (1) Experiments clarifying the effect of density variation owing to use of different gases, with and without the additional effect of density variation due to high Mach number or other effects; (2) experiments clarifying the role and importance of various parameters which determine the behavior of the near field as well as the condictions under which any of these parameters can be neglected; (3) experiments determining the cumulative effect of initial conditions in terms of distance to fully established flow; (4) experiments for cases where two layers of distinctly different initial turbulence structure flow side by side at the same mean speed; and (5) experiment using contemporary experimental techniques to study structure in free turbulent shear flows in order to compliment and support contemporary work on boundary layers.
D.L.G.

N73-28173* Illinois Inst. of Tech., Chicago.
REPORT OF CONFERENCE EVALUATION COMMITTEE
Mark V. Morkovin, Dennis M. Bushnell (NASA. Langley Res. Center), R. B. Edelman (Gen. Appl. Sci. Labs., Inc.), and Paul A. Libby (Calif. Univ., San Diego) *In* NASA. Langley Res. Center Free Turbulent Shear Flows, Vol. 1 1973 p 673-761 refs (For availability see N73-28154 19-12)
CSCL 20D

A general classification is made of a number of approaches used for the prediction of turbulent shear flows. The sensitivity of these prediction methods to parameter values and initial data are discussed in terms of variable density, pressure fluctuation, gradient diffusion, low Reynolds number, and influence of geometry.
D.L.G.

N73-28174*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DISPERSION OF TURBOJET ENGINE EXHAUST IN FLIGHT
James D. Holdeman Washington Aug. 1973 23 p refs
(NASA-TN-D-7382; E-7479) Avail: NTIS HC $3.00 CSCL 20D

The dispersion of the exhaust of turbojet engines into the atmosphere is estimated by using a model developed for the mixing of a round jet with a parallel flow. The analysis is appropriate for determining the spread and dilution of the jet exhaust from the engine exit until it is entrained in the aircraft trailing vortices. Chemical reactions are not expected to be important and are not included in the flow model. Calculations of the dispersion of the exhaust plumes of three aircraft turbojet engines with and without afterburning at typical flight conditions are presented. Calculated average concentrations for the exhaust plume from a single engine jet fighter are shown to be in good agreement with measurements made in the aircraft wake during flight. Author

N73-28175*# United Aircraft Corp., East Hartford, Conn.
EXPERIMENTAL AND ANALYTICAL STUDY OF ONE- AND TWO-COMPONENT FLOWS IN SPHERICAL CHAMBERS
Bruce V. Johnson Washington NASA Aug. 1973 72 p refs
(Contract NAS3-13446)
(NASA-CR-2282; UARL-M910963-36) Avail: NTIS HC $3.00 CSCL 20D

A study was conducted to evaluate techniques for obtaining high inner-gas concentrations in a spherical cavity for application to the open-cycle gaseous-core nuclear rocket. The study included flow visualization tests with water and gases as the working fluids, calculations of the streamline distribution, and calculation and measurement of the inner-gas concentration with air and Freon-11 as the inner-stream gases. The cavity shape, the outer-stream injection conditions, the turbulent transport coefficients, and the buoyancy effects were found to affect the inner-stream flow patterns. Author

N73-28176# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace Engineering.
VECTORED INJECTION INTO NON-ADIABATIC BOUNDARY LAYER FLOWS INCLUDING INCIPIENT SEPARATION
G. R. Inger and T. F. Swean, Jr. Jun. 1973 96 p refs
(Grant NSF GK-20379)
(VPI-Aero-003) Avail: NTIS HC $7.00

A basic theoretical investigation of self-similar isobaric boundary layer solutions is presented for a wide range of normal and tangential surface mass transfer velocities (vectored injection and suction) including the effects of heat transfer. A new set of double-valued solutions pertaining to the case of small-to-moderate upstream vectoring is identified and studied. Also, the frictional heating associated with vectoring is shown to have a significant effect on the heat transfer and recovery factor for high speed flows. Detailed results are also presented for skin friction, velocity and enthalpy profiles, and momentum and displacement thickness integral properties. Author

N73-28177*# Michigan State Univ., East Lansing. Div. of Engineering Research.
PRELIMINARY RESULTS FOR A LARGE ANGLE OBLIQUE JET IMPINGEMENT AND FLOW AND FOR THE EFFECT OF INITIAL CONDITIONS ON THE NEAR FIELD OF AN AXISYMMETRIC JET Semiannual Report
John F. Foss and Stanley J. Kleis 25 May 1973 61 p refs
(Grant NGR-23-004-068)
(NASA-CR-121257; SAR-3) Avail: NTIS HC $5.25 CSCL 20D

The structure of an axisymmetric jet in the near field is discussed for jet noise and for jet impingment schemes for STOL aircraft. It is inferred from previous studies, and the inference is supported by analysis, that the scale and intensity of the turbulence structure at the jet exit plane are the important boundary conditions which effect the development of the flow in the near field. The techniques to study these effects while maintaining a uniform mean flow and the results which document the range of the initial conditions are presented. The large angle, oblique jet impingment condition is of interest in terms of the jet/flap interaction. Detailed turbulence data can be obtained with the specially constructed facility. The development of the flow and instrumentation system and initial data from the new facility are presented. Author

N73-28178*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RETRIEVAL OF DISPERSIVE AND CONVECTIVE TRANSPORT PHENOMENA IN FLUIDS USING STATIONARY AND NONSTATIONARY TIME DOMAIN ANALYSIS
J. Briscoe Stephens and Robert M. St.John (Okla. Univ., Norman) Washington Aug. 1973 104 p refs Revised
(NASA-TN-D-7240; M-106-Rev) Avail: NTIS HC $3.00 CSCL 20D

Simultaneously occuring dispersive and convective components of fluid kinematics are obtained by a time domain analysis of optically retrieved temporal histories of the transport phenomena. Utilizing triangulation of collimated optical fields of view from two radiometers to obtain the temporal histories of the intensity fluctuations associated with the transport phenomena has enabled investigators to retrieve the local convective transport by employing correlation statistics. The location of the peak in the covariance curve determines the transit time from which the convection velocity is calculated; whereas, the change in shape of the peak in the covariance curve determines the change in average frequency of the wave packet from which the dispersion velocity is calculated. Thus, two-component analysis requires the maximum possible enhancement of the delineation for the transport. The convection velocity is the result of a fixed reference frame calculation whereas, the dispersion velocity is the result of a moving reference frame calcuation. Author

N73-28179*# Martin Marietta Corp., Denver, Colo.
FILTER REGENERATION SYSTEMS Patent Application
Victor A. DesCamp, Michael W. Boex, Michael W. Hussey, and Thomas P. Larson, inventors (to NASA) Filed 3 Aug. 1973 21 p
(Contract NAS9-11984)
(NASA-Case-MSC-14273-1; US-Patent-Appl-SN-385522) Avail: NTIS HC $3.25 CSCL 20D

A system for regenerating a fluid filter where the filter normally retains particulate matter entrained in the fluid flow is described. The construction and operation of the equipment are discussed. The invention was directed toward a spacecraft fluid system design and filter maintenance techniques for possible in-flight maintenance on space shuttles. The invention is unique through the jet impingement action during the back flushing cycle.
NASA

N73-28180*# Massachusetts Inst. of Tech., Cambridge. Continuum Electromechanics Group.
RESEARCH IN ELECTROHYDRODYNAMICS Final Report
1 Jun. 1973 17 p refs
(Grant NGL-22-009-014)
(NASA-CR-133456) Avail: NTIS HC $3.00 CSCL 20D

An overview is presented in the form of publications for NASA research in electrohydrodynamics. Data cover basic electrohydrodynamics, management of liquids in zero gravity, continuum feedback control, and magnetohydrodynamics and ferrohydrodynamics. E.H.W.

N73-28181# California Univ., Livermore. Lawrence Livermore Lab.
PRELIMINARY MODEL FOR TRANSIENT FLOW OF COMPRESSIBLE, CONDENSABLE FLUID MIXTURES IN OPEN CONDUITS
R. B. Rozsa 12 Dec. 1972 45 p refs
(Contract W-7405-eng-48)
(UCID-16170) Avail: NTIS HC $4.25

The flow of fluids from underground nuclear detonations is of interest because of the environmental impact of venting radioactive species into the atmosphere. A simple mathematical model is proposed for calculating the transient flow of mixtures of condensable and noncondensable fluids in open channels. Preliminary calculations that use an explicit numerical formulation are shown to predict qualitatively the behavior expected of these systems. Sample computer runs are presented for air-and-water mixtures flowing in a crack 1 m long and 0.010 in. wide. Additional modifications are discussed. Author (NSA)

N73-28182# Siemens-Schuckertwerke A.G., Erlangen (West Germany).

FLOW MEASUREMENT AT THE BOTTOM OF THE LOWER PLENUM OF A PRESSURIZED WATER REACTOR CONTAINER [STROEMUNGSTECHNISCHE UNTERSUCHUNGEN DES UNTEREN KUGELBODENS EINES DRUCKWASSERREAKTORBEHAELTERS]

E. Weber and W. Dittrich Bonn Bundesmin. fuer Forsch. und Technol. Mar. 1973 64 p In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-K-73-03) Avail: NTIS HC $5.25; Zentralstelle fuer Atomkernenergie-Dokumentation (ZAED), Leopoldshafen, West Ger. 13 DM

Flow velocity distribution in the lower plenum of a pressurized water reactor was investigated in order to equalize this distribution by an optimal design for the core catching structure. Investigations were carried out with an air model of a 4-loop reactor. Flow patterns in the lower plenum were measured, and the number and position of phases of the core catching structure were varied. The distance between the bottom of the plenum and the lowest plate was found to be of decisive importance. This distance must be smaller than the width of the jet produced by an annulus. The equalizing effect of a slight swirl or a cylindrical screen was shown. ESRO

N73-28183# Hamburgische Schiffbau-Versuchsanstalt G.m.b.H. (West Germany).

INVESTIGATION ON THE PROBLEM OF GLASS FIBER REINFORCED PLASTIC PROPELLERS FOR SUBMARINES [UNTERSUCHUNGEN ZUM PROBLEM: GFK-PROPELLER FUER U-BOOTE]

J. Krohn Bonn Bundeswehramt 1973 28 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVG-FBWT-73-8) Avail: NTIS HC $3.50; Bundeswehramt 25 DM

The hydrodynamic behavior of glass fiber reinforced submarine propellers was compared with that of bronze propellers. The chord lengths were calculated for different thicknesses of blade sections based on the hydrodynamic conditions and geometric data of an existing bronze type. The expected bending stresses were calculated. For these blade sections with different dimensions, the behavior with respect to cavitation and efficiency were considered. The results of the investigations show that the hydrodynamic behavior of a glass fiber reinforced propeller is not worse than that of a bronze propeller. ESRO

N73-28184# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany).

STABILITY OF HAGEN-POISEUILLE FLOWS WITH SUPERPOSED RIGID ROTATION [STABILITAET VON HAGEN-POISEUILLE-STROEMUNGEN MIT UEBERLAGERTER STARRER ROTATION]

P.-A. Mackrodt Max-Planck-Inst. fuer Stroemungsforsch. and Aerodyn. Versuchsanstalt 1971 76 p refs In GERMAN

(Mitt-55) Avail: NTIS HC $6.00

The stability of a Hagen-Poiseuille flow with superposed fixed rotation (laminar pipe flow), was investigated with regard to its behavior with small three-dimensional perturbations. The system of linear, normal, homogeneous, differential equations derived from the Navier-Stokes equation was numerically solved for the range of Reynolds numbers smaller than or equal to 1000. Neutral curves were established for several axial and azimuthal wave numbers, all of them within a stability limit, on which the azimuthal wave number equals -1. Some simple experiments confirm this stability limit. In addition it was shown that, in a pure Hagen-Poiseuille flow, small three-dimensional perturbations with azimuthal wave numbers larger than 1 are damped more strongly than with wave numbers equal to 1. Author (ESRO)

N73-28185# Naval Postgraduate School, Monterey, Calif.

A STUDY OF TURBULENT WAKES IN CONSTANT STREAMWISE PRESSURE GRADIENTS M.S. Thesis

Terrance Edwards Anderson Mar. 1973 65 p refs

(AD-761389) Avail: NTIS CSCL 20/4

Two-dimensional turbulent wakes in constant adverse and favorable pressure gradients were studied experimentally. The static and dynamic pressures through the wake were obtained with calibrated Pradtl-type pitot-static probes, and a computer program was written to extract from these data the velocity profiles, displacement thickness, momentum thickness, and the shape factor. This program further provides the turbulent shear coefficient, eddy viscosity, and Prandtl mixing length within the wake. A wind tunnel was designed specifically for this experiment and its construction details are included. (Modified Author Abstract) GRA

N73-28186# Ocean and Atmospheric Science, Inc., Dobbs Ferry, N.Y.

BI-MODE HYPOTHESIS AND HORIZONTAL OCEANIC TURBULENT DIFFUSION. 1: THEORETICAL PREDICTIONS

E. Y. T. Kuo 28 Jun. 1972 64 p refs

(Contract N00014-72-C-0127)

(AD-762046; OAS-TR-72-089) Avail: NTIS CSCL 20/4

Horizontal diffusion in a distorting turbulent medium is studied in order to determine the lifetime and spatial extent of submarine wakes in various turbulent media. A familiar picture of turbulent diffusion is that of patches being acted upon by both small and large scale eddies. In the model selected here, there is isotropic turbulence in which there are only two distinct groups of eddies: those larger and those smaller than the instantaneous patch size. This is the bi-mode hypothesis. The apparent diffusivities of the combined bi-mode eddies were evaluated and the results were found to be the 4/3 power law. An additional analysis was made of the 4/3 law of ocean surface diffusion since this was felt to be perhaps the result of some peculiarities common to surface flows. Although the main text assumes that the initial distribution is a point source, a finite size source non-infinitesimal) source is discussed in the appendix. GRA

N73-28187# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.

VELOCITY AND TEMPERATURE DEVELOPMENT IN THE ENTRANCE REGION BETWEEN TWO ROTATING CONCENTRIC CYLINDERS Interim Report

Mohamad Reza Kadivar Jun. 1973 101 p refs

(Contract N00014-68-A-0144)

(AD-762049; ME-73-T57-16) Avail: NTIS CSCL 20/4

The study concerns a numerical investigation of incompressible flow in the entrance region of a concentric annulus with the inside cylinder rotating. The elliptical Navier Stokes equations are reduced to parabolic equations with the aid of straining coordinates and assuming high leakage Reynolds number. The system of equations is numerically integrated by the classical marching techniques which were developed for parabolic systems. The nondimensional mathematical system of equations is solved by the classical central difference Crank-Nicholson implicit scheme. The z and phi momentum equations and the energy equation are put in the form of a tri-diagonal matrix and are solved by the Gaussian reduction method. The program for the solution of velocity components was run without specifying any value for the Reynolds number. (Modified Author Abstract) GRA

N73-28188# Virginia Polytechnic Inst. and State Univ., Blacksburg. Coll. of Engineering.

INVISCID SMALL DISTURBANCE THEORY FOR NONUNIFORM TRANSONIC FLOWS

G. R. Inger and W. H. Mason May 1973 40 p refs

(Contract N00014-72-A-0136-0001; NR Proj. 061-197; NR Proj. 303-461-1)

(AD-761632; VPI-E-73-19) Avail: NTIS CSCL 20/4

The classical inviscid theory of irrotational small three dimensional perturbations in uniform transonic flows is extended to include arbitrarily-nonuniform non-adiabatic two dimensional or axisymmetric basic flows. It is shown that these nonuniformities introduce significant disturbance field vorticity, thereby invalidating the introduction of a potential function. A generalized form of the usual nonlinear transonic velocity perturbation equation and a set of disturbance vorticity relations are derived which clearly indicate the nonuniform flow effects; also developed are equations governing the pressure and total enthalpy disturbances. Extensions of the usual transonic similitude laws involving several new nonuniform flow parameters are formulated for disturbance fields caused either by inner boundary surface deflections or by an outer disturbance such as an impinging shock wave. Finally,

possible numerical and analytical methods of solution of the generalized transonic equations are discussed. (Modified Author Abstract) GRA

N73-28189# Institute for Defense Analyses, Arlington, Va.
FINAL STAGES OF WAKE COLLAPSE IN A STRATIFIED FLUID
Steven Weinberg Jan. 1973 46 p refs
(Contract DAHC15-73-C-0200)
(AD-761622; P-937; IDA-HQ-73-15011) Avail: NTIS CSCL 20/4

Wake collapse in a stratified fluid is studied in the linear approximation with particular attention to the late stages of its decay. For an infinite ocean with a constant Vaisala frequency, any smooth disturbance will eventually decay as the minus three halves power of t. An apparent discrepancy between this result and the work of Hartman and Lewis is traced to the sharp discontinuity in their initial conditions. The normal modes for a realistic problem with an ocean surface and bottom and a varying Vaisala frequency are treated by methods developed in potential scattering theory, and the results are then used to estimate the behavior of the disturbance at late times. GRA

N73-28190# Ocean and Atmospheric Science, Inc., Dobbs Ferry, N.Y.
TURBULENT DIFFUSION IN A STRATIFIED FLUID WITH APPLICATION TO THE OCEAN
Chester E. Grosch 21 Jun. 1972 67 p refs
(Contract N00014-72-C-0127; ARPA Order 1910)
(AD-761653; OAS-TR-72-092) Avail: NTIS CSCL 20/4

The turbulent diffusion of a passive scalar in a stratified fluid is studied using a simplified model for the calculations. A semi-empirical formula for the diffusion coefficient is obtained as a function of turbulent energy dissipation rate and scale of the diffusing patch. The formula is demonstrated to give values which are consistent with known experimental results. It is suggested that the diffusion coefficient at intermediate depths is an order of magnitude smaller than that observed in near surface waters. Using these values of the diffusion coefficients, calculations show that the mean concentration for a patch initially 100 meters across decreases by a factor of 10 in two hours near the surface, but in eight hours at intermediate depths. Author (GRA)

N73-28191# ARO, Inc., Arnold Air Force Station, Tenn.
VISCOUS EFFECTS IN LOW DENSITY NOZZLE FLOWS Final Report, 9 Mar. - 30 Nov. 1972
David L. Whitfield AEDC Jun. 1973 79 p refs
(ARO Proj. VY0202; ARO Proj. VC097)
(AD-761489; ARO-VKF-TR-73-8; AEDC-TR-73-52) Avail: NTIS CSCL 20/4

Viscous effects in low-density nozzle flows were investigated numerically, and comparisons were made with experimental data. The numerical method of Patankar and Spalding was modified to solve the internal laminar boundary-layer equations for two-dimensional flow or axisymmetric flow with or without transverse curvature. A listing is given of the computer code. Boundary-layer displacement thicknesses for typical nozzle geometries and flow conditions are presented. Solutions were obtained for specific conditions corresponding to experimental data. The result is a relatively fast, simple to use numerical procedure, which is shown to give results in good agreement with experimental data. Author (GRA)

N73-28192# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
FLOW VISUALIZATION USING A SELECTIVELY SENSITIVE FLUORESCENT DYE Final Report
David R. Campbell May 1973 17 p
(AD-761499; ARL-73-0075) Avail: NTIS CSCL 20/4

A technique of flow visualization which produces the equivalence of smoke lines in water is presented. The method consists of a fluorescent dye material, acting as a marker fluid, which is selectively responsive to ultraviolet light of a single wavelength. Under proper illumination, the dye provides a highly visible marker fluid, well-suited to conventional photography. Under normal lighting conditions, the dye is colorless and optically non-contaminating. Author (GRA)

N73-28193# Naval Postgraduate School, Monterey, Calif.
NUMERICAL EXPERIMENTS WITH THE TWO- AND THREE-DIMENSIONAL UNSTEADY NAVIER-STOKES EQUATIONS
Gustave Hokenson Apr. 1973 81 p
(AD-761459; NPS-57HW73041A) Avail: NTIS CSCL 20/4

The two- and three-dimensional unsteady Navier-Stokes equations are solved numerically for the flow field about an impulsively started flat plate. In attempting to obtain an exact time dependent solution, several significant results were observed. First, with regard to the formulation of the differential equations themselves, it appears that Poisson's equation for the pressure field is a fundamental equation in as much as it allows us to solve for pressure moat exactly at any given time. Secondly, the different equations must be carefully and consistently formulated. In this research, a non-uniform lateral grid, a unique interpretation of the continuity equation, and leap frog integration in time proved to be valuable techniques in obtaining an exact solution. Author (GRA)

N73-28194# Naval Postgraduate School, Monterey, Calif.
BUBBLE TRANSPORT THEORY WITH APPLICATION TO THE UPPER OCEAN
Garrett A. Garrettson 6 Apr. 1973 65 p refs
(AD-761999; NPS-61GR73041A) Avail: NTIS CSCL 20/4

The formalism of transport theory is adapted to a general description of bubble populations in a moving fluid. The bubble distribution, as a function of position, velocity, radius, and time, satisfies a Boltzmann type transport equation that is derived and then formally solved by the method of characteristics. Properties of the medium are specified and a bubble dynamics model is chosen. General expressions are written for bubble acceleration and radius change rate, and known models of bubble gas diffusion and drag are summarized for gas bubbles in liquids. Application to the upper ocean is discussed and illustrated with some sample calculations. (Modified Author Abstract) GRA

N73-28195# Army Foreign Science and Technology Center, Charlottesville, Va.
A TRANSFORMATION OF THE BASIC EQUATION OF IS GROMEKO FOR A TWO PARAMETER FLOW
Rogunovich 16 Mar. 1973 6 p refs Transl. into ENGLISH from Nauka i Tekhnika (USSR), 1968 p 247-250
(AD-762104; FSTC-HT-23-1640-72) Avail: NTIS CSCL 20/4

A method for transforming the flow equation for a two parameter flow is presented. Mathematical models describing the process are provided. Author

N73-28196# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLIED GAS DYNAMICS. THIRD EDITION
G. N. Abramovich 21 May 1973 1042 p refs Transl. into ENGLISH from the monograph "Prikladnaya Gazovaya Dinamika" Moscow, 1969 p 1-437, 516-824
(AD-762307; FTD-MT-24-35-73) Avail: NTIS CSCL 20/4

The bases of gas dynamics are set forth in application to the theory of jet engines and other gas machines and apparatuses. A detailed analysis is made of the theory of one-dimensional gas flows on which rest largely the contemporary methods of calculation of jet engines, vane machines, ejectors, wind tunnels, and test stands. Separate chapters are dedicated to the boundary-layer theory and theory of jets lying at the basis of the determination of the friction drag, velocity fields, and temperatures in nozzles, diffusers, combustion chambers, ejectors, etc. GRA

N73-28197# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERALIZED DEPENDENCES FOR THE PARAMETERS AT THE FLOW SEPARATION BOUNDARY IN COMPRESSOR CASCADES
E. Z. Madorskii 1 Jun. 1973 13 p refs Transl. into ENGLISH from Energomashinostroenie (USSR), no. 2, 1973 p 39-40
(AD-762238; FTD-HT-23-530-73) Avail: NTIS CSCL 21/5

One of the peculiarities of axial compressors is the presence of a boundary of separation modes. Operation beyond this boundary, in the unstable area, is excluded due to the low efficiency and the vibration of the blades, which can cause their breakdown.

The structural and gas-dynamic parameters of the cascades of blading rings are selected from the point of view of the optimum angles of rotation of flow and extent of pressure losses. In the report the structural and gas-dynamic parameters of the cascades are connected with the boundary of non-separated flow around the cascades. GRA

N73-28198# Air Force Systems Command, Wright-Patterson AFB, Ohio.
EXPERIMENTAL STUDY OF BASE PRESSURE OF ROUND CYLINDERS OF GREAT ELONGATION
V. M. Kovalenko, Kosorygin, and V. V. Shumskiy 8 Jun. 1973 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Tekhn Nauk (Novosibirsk), no. 8, Jun. 1972 p 67-70
(AF Proj. G101)
(AD-762243; FTD-HT-23-582-73) Avail: NTIS CSCL 20/4

A vacuum appears behind the blunt base of a body of revolution which is in a supersonic gas flow. The degree of the vacuum determines the magnitude of the base wake drag - one of the components of total drag of a body. GRA

N73-28199# Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
A PRELIMINARY REPORT ON THE ZERO-CROSSING-RATE TECHNIQUE FOR AVERAGE SHEAR MEASUREMENT IN FLOWING FLUID Project Report, Oct. 1968 - Apr. 1970
Joseph M. Wetzel and John M. Killen Nov. 1972 52 p refs
(Contracts N00014-67-A-0113-0007; N00014-67-A-0113-0015)
(AD-762059; Rept-134) Avail: NTIS CSCL 20/4

The characteristics of a flush-mounted hot film sensor were investigated in turbulent flows of both water and drag reducing polymer solutions in a 4-inch-diameter pipe. For water flows, a linear relationship was found between the average power supplied to the sensor and the cube root of the wall shear stress. With the addition of polymer additives, the heat transfer rates at a given shear stress were reduced from those found with water alone. Analysis of the heat transfer fluctuations occurring in various flow facilities has shown that the zero crossing rate is related to the wall shear stress and to fluid properties for water, polymer, and air flows. The zero crossing rate of the surface pressure fluctuations was found to be related to the local wall shear stress. (Modified Author Abstract) GRA

N73-28200# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A REEVALUATION OF ZERO PRESSURE GRADIENT COMPRESSIBLE TURBULENT BOUNDARY LAYER
James E. Danberg Apr. 1973 26 p refs
(DA Proj. 1T0-61102-A-33D)
(AD-762152; BRL-1642) Avail: NTIS CSCL 20/4

A number of compressible turbulent boundary layer velocity and temperature profiles with zero pressure gradient were collected and prepared for computer analysis. An assumed equation for these profiles were chosen allowing four constants to be adjusted by a nonlinear least squares technique to fit the experimental data. The four constants are: velocity scale, boundary layer thickness, constant of the semi-log region, and wake constant. This equation is analogous to Cole's incompressible law of the wall and wake but uses a generalized velocity to account for compressibility. Measurements from 45 adiabatic wall tests were analyzed covering a Mach number range from 2 to 6 and a momentum thickness Reynolds number range from 2300 to 750,000. (Modified Author Abstract) GRA

N73-28201# Ocean and Atmospheric Science, Inc., Dobbs Ferry, N.Y.
SOME COMMENTS ON THE MODELING OF THE COLLAPSING WAKE
E. Y. T. Kuo and Chester E. Grosch 6 Jan. 1972 13 p
(Contract N00014-72-C-0127; ARPA Order 1910)
(AD-762454; OAS-TR-72-065) Avail: NTIS CSCL 20/4

The problem of scaling the phenomena of the collapse of the wake of a self-propelled body in a stratified fluid is examined. Conditions are derived such that the Froude number (based on body speed, length and Vaisala period) is equal for both model and prototype. Conditions are also obtained for the existence of buoyancy and inertial subranges in the wake turbulence. These conditions are applied to determine the smallest size model for which the phenomenon of wake growth and collapse is properly scaled from the prototype. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N73-28202 Texas A&M Univ., College Station.
THE NONLINEAR TRANSIENT RESPONSE OF A CONTINUOUSLY STRATIFIED, BAROCLINIC OCEAN TO STATIONARY AND TRANSITORY AXIALLY-SYMMETRIC ATMOSPHERIC CYCLONES Ph.D. Thesis
Kent Duane Gilbert 1972 154 p
Avail: Univ. Microfilms Order No. 70-19439

A study was made of the temporal and spatial theoretical description of circulation and mixing of sea water induced in an initially motionless, continuously stratified, uniformly rotating, baroclinic ocean by steady as well as transitory, axisymmetric, cyclonic atmospheric vortices. The nonlinear processes of lateral and vertical advection of momentum, heat, and salt are explicitly included in flux form in the governing hydrothermodynamic equations. Lateral as well as vertical turbulent diffusion of momentum and thermal properties are included in gradient form, but all exchange coefficients are held constant, with assumed Prandtl numbers of unity in the respective horizontal and vertical directions. Additional pertinent constraints include constant Coriolis parameter, use of the hydrostatic approximation in an incompressible ocean, and imposition of the rigid-lid approximation along the sea surface. Changes in thermal properties across the air-sea interface are permitted. Dissert. Abstr.

N73-28203 New York Univ., N.Y.
A HIGH RESOLUTION SPECTROSCOPIC STUDY OF THE ATMOSPHERIC WATER VAPOR LINE AT 6943.8 ANGSTROMS Ph.D. Thesis
James Thomas Bradley 1972 109 p
Avail: Univ. Microfilms Order No. 73-9099

A high resolution spectroscopic study of the 6943.8 Angstrom water vapor line in the telluric spectrum has been undertaken. Atmospheric absorption measurements were taken using a scanning slit photometer located at the exit plane of a ten meter Czerny-Turner spectrometer. An analysis has been made of the errors and bias introduced into line parameters due to the physical slit widths, the speed of the scanning system, and various atmospheric effects. The value for the line half-width is within the range of experimental error of the commonly accepted value while the line strength is a factor of two less than the commonly accepted value. This new lower value for the line strength will be important for a more accurate determination of vibration-rotation ineractions of the water vapor molecule. This line strength value will also be used to put laser radar profiles of atmospheric humidity on a quantitative basis. Dissert. Abstr.

N73-28204 Minnesota Univ., Minneapolis.
THE ELECTRON ECHO EXPERIMENT: OBSERVATIONS OF THE CHARGE NEUTRALIZATION OF THE ROCKET AND ANALYSIS OF THE ECHOES FROM ELECTRONS ARTIFICIALLY INJECTED INTO THE MAGNETOSPHERE Ph.D. Thesis
Richard Arthur Hendrickson 1972 220 p
Avail: Univ. Microfilms Order No. 73-10573

For the Electron Echo 1 experiment, a sounding rocket carried an electron gun, there electron detectors, and related apparatus 350 km above Wallops Island, Virginia. The electron gun injected over 3000 pulses of electrons into the earth's magnetosphere. Each pulse was 70 ma, 16 msec long, with the electron energy swept from 34 to 43 keV. The electrons were injected with pitch angles between 65 deg and 115 deg and became trapped in the earth's dipole like magnetic field. The trapped electrons bounced back and forth between their northern and southern mirror points with an approximately 65 second period and the mirror points drifted eastward with an approximately 750 m/sec

average velocity. The rocket was launched eastward and for about 95 seconds and matched the mirror point drift velocity, both in magnitude and direction, sufficiently well to allow electrons to be detected after one, two, and in one case, three bounces. Dissert. Abstr.

N73-28205*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Geological Sciences.
GEOLOGIC LANDFORM ANALYSIS IN THE CENTRAL PIEDMONT OF VIRGINIA AND NORTH CAROLINA, 1 Interim Report, Mar. - Aug. 1973
Lynn Glover, III, Principal Investigator 1 Aug. 1973 9 p ref ERTS
(Contract NAS5-21729)
(E73-10766; NASA-CR-133206) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. ERTS-1 imagery in the central Piedmont of Va. and N.C. reveals some geologic structures in the Precambrian and Paleozoic metamorphic terrain as well as structure in the younger Triassic deposits. A major synform five miles wide and more than 20 miles long has been identified in the metamorphic rocks north of Danville, Va. Structures in the metavolcanic Carolina slate belt are also identifiable near the confluence of the Dan and Staunton Rivers. Cleared land and other cultural features tend to coincide with topographic reflection of geologic units, thus enhancing the ERTS-1 resolution of some geologic structures. In other cases pseudostructures may be identified when regular geometric configurations of culture bear little or no relation to underlying geologic units. Interpreting geologic structure in the nearly flat and deeply weather Piedmont is a severe test of ERTS-1 imagery resolution. Doubling the resolution and providing stereoscopic overlap would increase the geologic usefulness of these photographs many fold.

N73-28206*# Tel-Aviv Univ. (Israel). Dept. of Environmental Sciences.
MULTIDISCIPLINARY USES IN ISRAEL Progress Report, 1 Jan. - 30 Jun. 1973
Joseph Otterman, Principal Investigator 2 Jul. 1973 5 p refs Sponsored by NASA ERTS
(E73-10800; NASA-CR-133133) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-28207*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYMPOSIUM ON SIGNIFICANT RESULTS OBTAINED FROM THE EARTH RESOURCES TECHNOLOGY SATELLITE-1. VOLUME 1: TECHNICAL PRESENTATIONS, SECTIONS A AND B
Stanley C. Freden, ed., Enrico P. Mercanti, ed., and Margaret A. Becker, ed. 1973 1686 p refs Symp. held at New Carrollton, Md., 5-9 Mar. 1973 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E73-10824; NASA-SP-327; LC-73-600115) Avail: NTIS MF $0.95; SOD HC $13.65 Domestic Postpaid or $12.50 GPO Bookstore per set as NAS 1.21:327 CSCL 05B

The proceedings of a conference on the significant results obtained by remote sensors mounted in the ERTS-1 satellite are presented. The subjects discussed include the following: (1) agriculture, forestry and range resources, (2) mineral resources, (3) geological structures and landform surveys, (4) environmental surveys, (5) water resources, (6) land use and mapping, (7) development of interpretation techniques, (8) marine resources and ocean surveys, and (9) regional resource surveys. For individual titles, see N73-28208 through N73-28388.

N73-28208* General Electric Co., Philadelphia, Pa.
ERTS-1 DATA PRODUCT PERFORMANCE
B. T. Bachofer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1-9 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 05B

The quality of the ERTS-1 data products produced during the initial months of system operation are evaluated. Quantitative performance data - principally geometric and radiometric accuracy and resolution - are determined for these data products. A comparison of these measurements with prelaunch predictions is also made. Author

N73-28209* Kansas Univ. Center for Research, Inc., Lawrence.
IDENTIFICATION OF WINTER WHEAT FROM ERTS-1 IMAGERY
Donald L. Williams, Stanley A. Morain, Bonnie Barker, and Jerry C. Coiner *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 11-18 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A1) CSCL 02C

Continuing interpretation of the test area in Finney County, Kansas, has revealed that winter wheat can be successfully identified. This successful identification is based on human recognition of tonal signatures on MSS images. Several different but highly successful interpretation strategies have been employed. These strategies involve the use of both spectral and temporal inputs. Good results have been obtained from a single MSS-5 image acquired at a critical time in the crop cycle (planting). On a test sample of 54,612 acres, 89 percent of the acreage was correctly classified as wheat or non-wheat and the estimated wheat acreage (19,516 acres) was 99 percent of the actual acreage of wheat in the sample area. Author

N73-28210* California Univ., Riverside. Dept. of Geography.
SEMI-AUTOMATIC CROP INVENTORY FROM SEQUENTIAL ERTS-1 IMAGERY
Claude W. Johnson and Virginia B. Coleman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 19-25 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A2) CSCL 02C

The detection of a newly introduced crop into the Imperial (California) Valley by sequential ERTS-1 imagery is proving that individual crop types can be identified by remote sensing techniques. Initial results have provided an extremely useful product for water agencies. A system for the identification of field conditions enables the production of a statistical summary within two to three days of receipt of the ERTS-1 imagery. The summary indicates the total acreage of producing crops and irrigated planted crops currently demanding water and further indicates freshly plowed fields that will be demanding water in the near future. Relating the field conditions to the crop calendar of the region by means of computer techniques will provide specific crop identification for the 8000 plus fields. Author

N73-28211* South Dakota State Univ., Brookings.
CROP IDENTIFICATION USING ERTS IMAGERY
Maurice L. Horton and James L. Heilman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 27-33 refs Submitted for publication ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21774)
(Paper-A3; SDSU-RSI-J-73-02) CSCL 02C

Digital analysis of August 15 ERTS-I imagery for southeastern South Dakota was performed to determine the feasibility of conducting crop surveys from satellites. Selected areas of bands 4, 5, 6, and 7 positive transparencies were converted to digital form utilizing Signal Analysis and Dissemination Equipment (SADE). The optical transmission values were printed out in a spatial format. Visual analysis of the printouts indicated that cultivated areas were readily distinguished from non-cultivated areas in all four bands. Bare soil was easily recognized in all four bands. Corn and soybeans, the two major crops in the area, were treated as separate classes rather than as a single

class called row crops. Bands 6 and 7 provided good results in distinguishing between corn and soybeans. Author

N73-28212* Polytechnical Univ. of Madrid (Spain).
IDENTIFICATION OF LARGE MASSES OF CITRUS FRUIT AND RICE FIELDS IN EASTERN SPAIN
Fernando Lopez deSagredo and Francisco G. Salinas *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 35-36 ERTS (For availability see N73-28207 19-13)
(Paper-A4) CSCL 02C

ERTS-1 imagery has been successfully used for the identification of large areas of citrus groves and rice fields in the Valencia region of Eastern Spain. Results are encouraging and will facilitate the elaboration of a land use map with a fair degree of definition once methods prove to be fully operational. Author

N73-28213* General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.
ENGINEERING ANALYSIS OF ERTS DATA FOR SOUTHEAST ASIAN AGRICULTURE
Howard L. Heydt and Arthur J. McNair (Cornell Univ., Ithaca, N. Y.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 37-52 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A5), CSCL 02C

The present program focuses on rice because of its importance world-wide as a food. Specifically, the focus is on rice fields in the Philippines. Two primary program objectives are: (1) to establish the feasibility of extracting from ERTS imagery the areas where rice is grown, and (2) to determine those measurements on the imagery which enable the assessment of crop condition. Achieving these objectives with procedures which can be cost-effective can lead the way toward yield prediction, irrigation system management, and similar functions which are known to be important needs in Southeast Asia. Author

N73-28214* Earth Satellite Corp., Berkeley, Calif.
AN INTERREGIONAL ANALYSIS OF NATURAL VEGETATION ANALOGUES USING ERTS-1 IMAGERY
Charles E. Poulton and Robin I. Welch *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 53-57 ref ERTS (For availability see N73-28207 19-13)
(Paper-A6) CSCL 02C

The identification of ecological analogs of natural vegetation and food crops using ERTS-1 imagery is discussed. Signatures of four natural vegetation analogs have been determined from color photography. Color additive techniques to improve the photointerpretation are examined. Tests were conducted at test sites in Louisiana, California, and Colorado. Author

N73-28215* Oregon State Univ., Corvallis. Rangeland Resources Program.
NATURAL VEGETATION INVENTORY
Barry J. Schrumpf *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 59-66 refs ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21831)
(Paper-A7) CSCL 08F

Unique characteristics of ERTS imagery can be used to inventory natural vegetation. While satellite images can seldom be interpreted and identified directly in terms of vegetation types, such types can be inferred by interpretation of physical terrain features and through an understanding of the ecology of the vegetation. Author

N73-28216* Alaska Univ., Fairbanks.
VEGETATIVE AND GEOLOGIC MAPPING OF THE WESTERN SEWARD PENINSULA, ALASKA, BASED ON ERTS-1 IMAGERY
James H. Anderson, Lewis Shapiro, and Albert E. Belon *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 67-72 refs ERTS (For availability see N73-28207 19-13)
(Paper-A8)

ERTS-1 scene 1009-22095 (Western Seward Peninsula, Alaska) has been studied, partly as a training exercise, to evaluate whether direct visual examination of individual and custom color-composite prints can provide new information on the vegetation and geology of this relatively well known area of Alaska. The vegetation analysis reveals seven major vegetation types, only four of which are described on existing vegetation maps. In addition, the ERTS analysis provides greater detail than the existing maps on the areal distribution of vegetation types. The geologic analysis demonstrates that most of the major rock units and geomorphic boundaries shown on the available geologic maps could also be identified on the ERTS data. Several major high-angle faults were observed, but the zones of thrust faults which are much less obvious. Author

N73-28217* Nevada Univ., Reno. Remote Sensing Lab.
ERTS-1 EVALUATION OF NATURAL RESOURCES MANAGEMENT APPLICATIONS IN THE GREAT BASIN
Paul T. Tueller and Garwin Lorain *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 77-85 ERTS (For availability see N73-28207 19-13)
(Paper-A9) CSCL 01F

The relatively cloud free weather in the Great Basin has allowed the accumulation of several dates of excellent ERTS-1 imagery. Mountains, valleys, playas, stream courses, canyons, alluvial fans, and other landforms are readily delineated on ERTS-1 imagery, particularly with MSS-5. Each band is useful for identifying and studying one or more natural resource features. For example, crested wheatgrass seedings were most easily identified and measured on MSS-7. Color enhancements simulating CIR were useful for depicting meadow and phreatophytic vegetation along water bodies and stream courses. Work is underway to inventory and monitor wildfire areas by age and successional status. Inventories have been completed on crested wheatgrass seedings over the entire State of Nevada, and inventories of playa surfaces, water surfaces, phreatophytic vegetation, snow cover, meadows, and other features is continuing. Vegetation ecotones are being delineated for vegetation mapping. The pinyon/juniper-northern desert shrub ecotone has been identified with considerable success. Phenology changes can be used to describe vegetation changes for management. Author

N73-28218* Nebraska Univ., Lincoln. Dept. of Agronomy.
EVALUATION OF ERTS-1 IMAGERY IN MAPPING AND MANAGING SOIL AND RANGE RESOURCES IN THE SAND HILLS REGION OF NEBRASKA
Paul M. Seevers and James V. Drew *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 87-89 ERTS (For availability see N73-28207 19-13)
(Paper-A10) CSCL 08B

Interpretations of high altitude photography of test sites in the Sandhills of Nebraska permitted identification of subirrigated range sites as well as complexes of choppy sands and sands range sites, units composing approximately 85% of the Sandhills rangeland. These range sites form the basic units necessary for the interpretation of range condition classes used in grazing management. Analysis of ERTS-1 imagery acquired during August, September and October, 1972 indicated potential for the identification of gross differences in forage density within given range sites identified on early season aerial photography. Author

N73-28219* California Univ., Berkeley. Forestry Remote Sensing Lab.
MONITORING CALIFORNIA'S FORAGE RESOURCE USING ERTS-1 AND SUPPORTING AIRCRAFT DATA
David M. Carneggie and Stephen D. DeGloria *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 91-95 ERTS (For availability see N73-28207 19-13)
(Paper-A11) CSCL 08F

NASA's Earth Resource Technology Satellite (ERTS-1) launched July 23, 1972, offers for the first time the unique

capabilities for regional monitoring of forage plant conditions. The repetitive coverage every 18 days, the synoptic view and the real-time recovery of the imagery for immediate analysis, combine to make the ERTS satellite a valuable tool for improving the evaluation of our rangeland resources. Studies presently underway at the University of California, Berkeley (sponsored jointly by NASA and the Bureau of Land Management), seek to determine if imagery obtained from high altitude aircraft and spacecraft (ERTS) can provide: (1) a means for monitoring the growth and development of annual and perennial range plants in California, and for determining the time and the rate of initial plant growth (germination) and terminal plant growth (maturation and senescence); (2) a means for determining or predicting the relative amount of forage that is produced; and (3) a means for mapping rangeland areas having different forage producing capabilities. Author

N73-28220* California Univ., Berkeley.
TESTING THE USEFULNESS OF ERTS-1 IMAGERY FOR INVENTORYING WILDLAND RESOURCES IN NORTHERN CALIFORNIA
Donald T. Lauer and Paul F. Krumpe *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 97-104 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A12) CSCL 08F

The usefulness of ERTS-1 imagery for inventorying wildland reyources in northern California is discussed. Studies are being conducted in two large wildland areas, namely, the Feather River Watershed and the Northern Coastal Zone. The 2.5 million-acre Feather River headwaters area in northern California is the keystone watershed for the California Water Project, one of the most extensive and ambitious water resource developments ever attempted. Consequently, accurate and timely information on the quantity, quality and distribution of timber, forage, water and recreational resources is of immediate importance to each public agency and private group managing this vast, but inaccessible, wildland area. The Northern Coastal Zone (consisting of the counties of Marin, Sonoma, Mendicino, Humbolt and Del Norte) is relatively rural, with an economy based on agriculture, timber, commercial fishing and tourism. However, it is expected that intensive resource use resulting from increasing population will soon become a serious problem unless wise land use planning is undertaken. Thus, this coastal region is particularly well suited to investigations of the ways in which ERTS-1 imagery and other supporting data may be used in conducting land use evaluations. Author

N73-28221* Centro Interamericano de Fotointerpretacion, Bogota (Colombia).
INTERPRETATION OF ERTS-MSS IMAGES OF A SAVANNA AREA IN EASTERN COLOMBIA
G. W. W. Elberson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect., A and B 1973 p 105-119 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A13) CSCL 08F

The application of ERTS-1 imagery for extrapolating existing soil maps into unmapped areas of the Llanos Orientales of Colombia, South America is discussed. Interpretations of ERTS-1 data were made according to conventional photointerpretation techniques. Most units delineated in the existing reconnaissance soil map at a scale of 1:250,000 could be recognized and delineated in the ERTS image. The methods of interpretation are described and the results obtained for specific areas are analyzed. Author

N73-28222* Tennessee Univ., Knoxville. Dept. of Soil Science and Electrical Engineering.
DELINEATION OF MAJOR SOIL ASSOCIATIONS USING ERTS-1 IMAGERY
W. L. Parks and R. E. Bodenheimer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 121-125 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A14) CSCL 08M

The delineation of a major soil association in the loess region of Obion County has been accomplished using ERTS-1 imagery. Channel 7 provides the clearest differentiation. The separation of other smaller soil associations in an intensive row crop agricultural area is somewhat more difficult. Soil differentiation has been accomplished visually as well as electronically using a scanning microdensitometer. Lower altitude aircraft imagery permits a more refined soil association identification and where imagery is of sufficient scale, even individual soils may be identified. Author

N73-28223* California Univ., Riverside.
EVALUATION OF REMOTE SENSING IN CONTROL OF PINK BOLLWORM IN COTTON
Virginia B. Coleman, Claude W. Johnson, and Lowell N. Lewis *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 127-133 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21771)
(Paper-A15) CSCL 02C

The use of satellite data from the ERTS-1 satellite for mapping the cotton acreage in the southern deserts of California is discussed. The differences between a growing, a defoliated, and a plowed down field can be identified using an optical color combiner. The specific application of the land use maps is to control the spread of the pink bollworms by establishing planting and plowdown dates. Author

N73-28224* Natural Resources Management Corp., Berkeley, Calif.
APPLICATION OF ERTS-1 IMAGERY AND UNDERFLIGHT PHOTOGRAPHY IN THE DETECTION AND MONITORING OF FOREST INSECT INFESTATIONS IN THE SIERRA NEVADA MOUNTAINS OF CALIFORNIA
Ralph C. Hall *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 135-142 Original contains imagery. Original Photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A16) CSCL 02F

The analysis of ERTS-1 imagery of areas in the Sierra Nevada Mountains of California is discussed. The data is used to detect two types of insect infestational and to determine the extent of timber resources. Addition applications are the mapping of stream courses, mountain meadows, lakes, rock outcrops, and grazing land. The ERTS-1 data and underflight photography are used for this purpose. Author

N73-28225* California Univ., Berkeley. Space Science Lab.
ERTS-1 IMAGERY AND HIGH FLIGHT PHOTOGRAPHS AS AIDS TO FIRE HAZARD APPRAISAL AT THE NASA SAN PABLO RESERVOIR TEST SITE
Robert N. Colwell *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 145-156 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A18) CSCL 08F

The identification of fire hazards at the San Pablo Reservoir Test Site in California using ERTS-1 data is discussed. It is stated that the two primary fire hazards in the area are caused by wild oat plants and eucalyptus trees. The types of imagery used in conducting the study are reported. Aerial photographs of specific areas are included to show the extent of the fire hazards. Author

N73-28226* Cornell Univ., Ithaca, N.Y.
PHENOLOGY SATELLITE EXPERIMENT
Bernard E. Dethier, Marshall D. Ashley (Maine Univ., Orono),

Byron Blair (Purdue Univ.), and Richard J. Hopp (Vt. Univ., Burlington) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 157-165 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A19) CSCL 08F

The detection of a phenological event (the brown wave-vegetation senescence) for specific forest and crop types using ERTS-1 imagery is described. Data handling techniques included computer analysis and photo interpretation procedures. Computer analysis of ERTS-1 multispectral scanner digital tapes in all bands was used to give the relative changes of spectral reflectance with time of forests and specified crops. These data were obtained for a number of the study's twenty-four sites located within four north-south corridors across the United States. Analysis of ground observation photography and ERTS-1 imagery for sites in the Appalachian Corridor and Mississippi Valley Corridor indicates that the recession of vegetation development can be detected very well. Tentative conclusions are that specific phenological events such as crop maturity or leaf fall can be mapped for specific sites and possibly for entire regions. Author

N73-28227* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FOREST AND RANGE MAPPING IN THE HOUSTON AREA WITH ERTS-1
G. R. Heath and H. D. Parker *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 167-172 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A20) CSCL 08B

ERTS-1 data acquired over the Houston area has been analyzed for applications to forest and range mapping. In the field of forestry the Sam Houston National Forest (Texas) was chosen as a test site, (Scene ID 1037-16244). Conventional imagery interpretation as well as computer processing methods were used to make classification maps of timber species, condition and land-use. The results were compared with timber stand maps which were obtained from aircraft imagery and checked in the field. The preliminary investigations show that conventional interpretation techniques indicated an accuracy in classification of 63 percent. The computer-aided interpretations made by a clustering technique gave 70 percent accuracy. Computer-aided and conventional multispectral analysis techniques were applied to range vegetation type mapping in the gulf coast marsh. Two species of salt marsh grasses were mapped. Author

N73-28228* Michigan State Univ., East Lansing. Michigan Agricultural Experiment Station.
APPLICATION OF ERTS-1 DATA TO ANALYSIS OF AGRICULTURAL CROPS AND FORESTS IN MICHIGAN
Gene R. Safir, Wayne L. Myers, William A. Malila (Environ. Res. Inst. of Mich.), and James P. Morgenstern (Environ. Res. Inst. of Mich.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 173-180 ERTS (For availability see N73-28207 19-13)
CSCL 08F

The results reported are based on analysis of ERTS Frame 1033-15580 collected over southwestern Lower Michigan on August 25, 1972. Major agricultural crops such as corn and soybeans were approaching maturity at this data and forest canopies were dense. Extensive ground truth information was gathered by detailed field study of test strips. This detailed information was supplemented over larger areas by interpretation of RB-57 and C-47 photography and MSS imagery. Recognition processing of ERTS-1 MSS data was carried out on a digital computer. Fields and forest stands were selected as training sets and test areas. Aerial imagery was essential for locating the positions of these selected areas on ERTS digital tapes. The recognition process was successful for each type of vegetation which had a dense green canopy such as forests, corn, and soybeans. Bare soil was also recognizable as a category. Author

N73-28229* Environmental Research Inst. of Michigan, Ann Arbor.
CROP SPECIES RECOGNITION AND MENSURATION IN THE SACRAMENTO VALLEY
Frederick J. Thomson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 181-188 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-A22) Avail: NTIS CSCL 02C

The goal of the second recognition map was to delineate various crop species in a portion of the Sacramento Valley, and at the same time to determine how accurately each could be classified and measured from ERTS-1 data. The new recognition map, a new and concise display of the old map, and classification and mensuration accuracy data are presented and discussed. The mensuration accuracy, in particular, is affected by the presence of an edge effect one resolution wide surrounding nearly all fields. Points on the edge are misclassified because they contain a mixture of, crop and bare soil. Using a processing technique to estimate the proportions of unresolved objects in this edge region a much improved mensuration capability will be demonstrated. Author

N73-28230* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE RESULTS OF AN AGRICULTURAL ANALYSIS OF THE ERTS-1 MSS DATA AT THE JOHNSON SPACE CENTER
R. M. Bizzell, L. C. Wade, H. L. Prior, and B. Spiers *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 189-196 ERTS (For availability see N73-28207 19-13)
(Paper-A23) CSCL 02C

The initial analysis of the ERTS-1 multispectral scanner (MSS) data at the Johnson Space Center (JSC), Houston, Texas is discussed. The primary data set utilized was the scene over Monterey Bay, California, on July 25, 1972, NASA ERTS ID No. 1002-18134. It was submitted to both computerized and image interpretative processing. An area in the San Joaquin Valley was submitted to an intensive evaluation of the ability of the data to (1) discriminate between crop types and (2) to provide a reasonably accurate area measurement of agricultural features of interest. The results indicate that the ERTS-1 MSS data is capable of providing the identifications and area extent of agricultural lands and field crop types. Author

N73-28231* California Univ., Berkeley. Forestry Remote Sensing Lab.
AGRICULTURAL APPLICATIONS OF ERTS-1 DATA
William C. Draeger *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 197-204 ERTS (For availability see N73-28207 19-13)
(Paper-A24) Avail: NTIS CSCL 02C

In an attempt to evaluate the usefulness of ERTS imagery for the production of land use stratifications as a preliminary step in the crop inventory process, all land within San Joaquin County was delineated into broad land use and crop category classes based on their appearance on the ERTS-1 Color composite image. The stratification of the agricultural land use categories proved to be a relatively simple task, taking each of three interpreters approximately 30 minutes to complete. The three interpretations were quite similar requiring only minor revisions to produce a consensus stratification. A total of 13 different agricultural strata were recognized, differing both in general field size and relative proportions of crop types and degree of irrigation. Upon comparing these interpretations, it was concluded that nearly all boundaries were truly representative of differing cropping practices. In a number of cases, the stratifications agreed almost exactly with soil type boundaries as drawn by earlier soils surveys. Author

N73-28232* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
IDENTIFICATION OF AGRICULTURAL CROPS BY COMPUTER PROCESSING OF ERTS MSS DATA
Marvin E. Bauer and Jan E. Cipra *In* NASA. Goddard Space

Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 205-212 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21773; Grant NGL-15-005-112)
(Paper-A25) CSCL 02C

Quantitative evaluation of computer-processed ERTS MSS data classifications has shown that major crop species (corn and soybeans) can be accurately identified. The classifications of satellite data over a 2000 square mile area not only covered more than 100 times the area previously covered using aircraft, but also yielded improved results through the use of temporal and spatial data in addition to the spectral information. Furthermore, training sets could be extended over far larger areas than was ever possible with aircraft scanner data. And, preliminary comparisons of acreage estimates from ERTS data and ground-based systems agreed well. The results demonstrate the potential utility of this technology for obtaining crop production information. Author

N73-28233* New York State Museum and Science Service, Albany.
EVALUATION OF ERTS-1 IMAGERY FOR GEOLOGICAL SENSING OVER THE DIVERSE GEOLOGICAL TERRAINS OF NEW YORK STATE
Yngvar W. Isachsen, Robert H. Fakundiny, and Stephen W. Forster *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 223-230 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21764)
(Paper-G1) CSCL 08G

Film positives of ERTS-1 imagery, both as received from NASA and photographically reprocessed, are analyzed by conventional and color additive viewing methods. The imagery reveals bedrock and surficial geological information at various scales. Features which can be identified to varying degrees include boundaries between major tectonic provinces, lithological contacts, foliation trends within massive gneisses, faults, and topographic lineaments. In the present imagery the greatest amount of spectral geology is displayed in the Adirondack region where bedrock geology is strongly linked to topography. Within this basement complex, the most prominantly displayed features are numerous north-northeast trending faults and topographic lineaments, and arcuate east-west valleys developed in some of the weaker metasedimentary rocks. The majority of the faults and lineaments shown on the geologic Map of New York at 1:250,000 appear in the ERTS imagery. Author

N73-28234* Pennsylvania State Univ., University Park. Dept. of Geosciences.
ANALYSIS AND APPLICATION OF ERTS-1 DATA FOR REGIONAL GEOLOGICAL MAPPING
D. P. Gold, R. R. Parizek, and S. A. Alexander *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 231-245 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G2) CSCL 08G

Combined visual and digital techniques of analysing ERTS-1 data for geologic information have been tried on selected areas in Pennsylvania. The major physiographic and structural provinces show up well. Supervised mapping, following the imaged expression of known geologic features on ERTS band 5 enlargements (1:250,000) of parts of eastern Pennsylvania, delimited the Diabase Sills and the Precambrian rocks of the Reading Prong with remarkable accuracy. From unsupervised mapping, transgressive linear features are apparent in unexpected density, and exhibit strong control over river valley and stream channel directions. They are unaffected by bedrock type, age, or primary structural boundaries, which suggests they are either rejuvenated basement joint directions on different scales, or they are a recently impressed structure possibly associated with a drifting North American plate. With ground mapping and underflight data, 6 scales of linear features have been recognized. Author

N73-28235* Utah Univ., Salt Lake City. Dept. of Geological and Geophysical Sciences.
GEOLOGY OF UTAH AND NEVADA BY ERTS-1 IMAGERY
Mead LeRoy Jensen *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 247-255 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G3) CSCL 08G

Repetitive ERTS-1 imagery covering Utah and Nevada is studied as an aid in structural geology, mineral exploration, and limnological and hydrological aspects. Limnological features of algal blooms and varying biological activities in Utah Lake and the Great Salt Lake are grossly evident on the imagery with more subtle details detected on the different bands. Major structural breaks, lineages, or trends are abundant throughout the area of study. The correlation of positive aeromagnetic anomalies with the trends suggests near surface intrusive bodies, not yet exposed at the surface, that can be tested for possible associated mineralization by collecting soil-gas at the surface which is analyzed for mercury that is (1) apparently associated with mineralization, (2) escapes as a vapor, and (3) can be readily measured in extremely low amounts of less than 1 ppb by absorption. Author

N73-28236* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF GEMINI AND ERTS IMAGERY OBTAINED OVER SOUTHERN MOROCCO
Herbert W. Blodget and Arthur T. Anderson *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 265-272 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G5) CSCL 08B

A mosaic constructed from three ERTS MSS band 5 images enlarged to 1:500,000 compares favorably with a similar scale geologic map of southern Morocco, and a near-similar scale Gemini 5 photo pair. A comparative plot of lineations and generalized geology on the three formats show that a significantly greater number of probable fractures are visible on the ERTS imagery than on the Gemini photography, and that both orbital formats show several times more lineaments than were previously mapped. A plot of mineral occurrences on the structural overlays indicates that definite structure-mineralization relationships exist; this finding is used to define underdeveloped areas which are prospective for mineralization. More detailed mapping is possible using MSS imagery than on Gemini 5 photographs, and in addition, the ERTS format is not restricted to limited coverage. Author

N73-28237* Bureau de Recherches Geologiques et Minieres, Orleans (France).
CAPABILITY OF ERTS-1 IMAGERY TO INVESTIGATE GEOLOGICAL AND STRUCTURAL FEATURES IN A SEDIMENTARY BASIN (BASSIN PARISIEN, FRANCE)
Claude Cavelier, Jean-Yves Scanvic, Guy Weecksteen, and Alain Ziserman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G6) CSCL 08G

A preliminary study of the MSS imagery of a sedimentary basin whose structure is regular is reported. Crops and natural vegetation are distributed all over the site located under temperate climate. Ground data available concern plant species geology and tectonic and are correlated with results from ERTS 1 imagery. This comparison shows a good correlation. The main geological units are detected or enhanced by way of agricultural land use and/or natural vegetation. Alluvial deposits are outlined by vegetation grass land and poplar trees. Some spatial relationship

of geostructures, suspected until now, are identified or extended in associating results from different spectral bands. Author

N73-28238* Geological Survey, Denver, Colo.
APPLICATION OF ERTS-1 MULTISPECTRAL IMAGERY TO MONITORING THE PRESENT EPISODE OF ACCELERATED EROSION IN SOUTHERN ARIZONA
Roger B. Morrison and Maurice E. Cooley *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 283-290 ERTS (For availability see N73-28207 19-13)
(Paper-G7) CSCL 08M

An episode of accelerated arroyo-cutting and sheet erosion commenced about 1890 in southern Arizona, following several thousand years of generally sluggish erosion. For a 17,000-square-mile study area, ERTS-1 images, supplemented by ultrahigh-altitude (U-2 and RB-57) airphotos, are proving effective for producing the first comprehensive maps showing the distribution and seriousness of the post-1890 erosion features, for monitoring new erosion changes, and for assessing the effectiveness of ameliorative measures. Such data are essential for understanding and controlling the accelerated erosion, a key environmental problem in this region. Author

N73-28239* Geological Survey, Denver, Colo.
A STUDY OF MORPHOLOGY, PROVENANCE, AND MOVEMENT OF DESERT SAND SEAS IN AFRICA, ASIA, AND AUSTRALIA
Edwin D. McKee and Carol S. Breed *In* NASA. Goddard Space Flight Center Symp. on significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 291-303 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G8) CSCL 08M

A description and classification of major types of sand seas on the basis of morphological pattern and lineation are discussed. The steps involved in analyzing the patterns of deposits on ERTS-1 imagery, where the visible forms are mostly dune complexes rather than individual dunes are outlined. After completion of thematic maps portraying the pattern and lineation of the sand bodies, data on directions and intensity of prevailing and other winds are plotted on corresponding bases, as a preliminary to determination of internal structures through ground truth.
Author

N73-28240* National Center for Earthquake Research, Menlo Park, Calif.
ESTABLISHMENT, TEST AND EVALUATION OF A PROTOTYPE VOLCANO SURVEILLANCE SYSTEM
Pzter L. Ward, Jerry P. Eaton, Elliot Endo, David Harlow, Daniel Marquez, and Rex Allen *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 305-315 refs ERTS (For availability see N73-28207 19-13)
(Paper-G9) CSCL 08E

A volcano-surveillance system utilizing 23 multilevel earthquake counters and 6 biaxial borehole tiltmeters is being installed and tested on 15 volcanoes in 4 States and 4 foreign countries. The purpose of this system is to give early warning when apparently dormant volcanoes are becoming active. The data are relayed through the ERTS-Data Collection System to Menlo Park for analysis. Installation was completed in 1972 on the volcanoes St. Augustine and Iliamna in Alaska, Kilauea in Hawaii, Baker, Rainier and St. Helens in Washington, Lassen in California, and at a site near Reykjavik, Iceland. Installation continues and should be completed in April 1973 on the volcanoes Santiaguito, Fuego, Agua and Pacaya in Guatemala, Izalco in El Salvador and San Cristobal, Telica and Cerro Negro in Nicaragua. Author

N73-28241* Geological Survey, Washington, D.C.
SATELLITE GEOLOGICAL AND GEOPHYSICAL REMOTE SENSING OF ICELAND: PRELIMINARY RESULTS FROM ANALYSIS OF MSS IMAGERY
Richard S. Williams, Agust Boedvarsson (Icelandic Surveying Dept., Reykjavik), Sturla Fridriksson (Agr. Inst., Reykjavik), Gudmundur Palmason (Natl. Energy Authority, Reykjavik), Sigurjon Rist (Natl. Energy Authority, Reykjavik), Hlynur Sigtryggsson (Icelandic Meteorol. Serv. Reykjavik), Sigurdur Thorarinsson (Iceland Univ., Reykjavik), and Ingvi Thorsteinsson (Agr. Inst., Reykjavik) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 317-327 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G10) CSCL 08G

A binational, multidisciplinary research effort in Iceland is directed at an analysis of MSS imagery from ERTS-1 to study a variety of geologic, hydrologic, oceanographic, and agricultural phenomena. A preliminary evaluation of available MSS imagery of Iceland has yielded several significant results - some of which may have direct importance to the Icelandic economy. Initial findings can be summarized as follows: (1) recent lava flows can be delineated from older flows at Askja and Hekla; (2) MSS imagery from ERTS-1 and VHRR visible and infrared imagery from NOAA-2 recorded the vocanic eruption on Heimaey, Vestmann Islands; (3) coastline changes, particularly changes in the position of bars and beaches along the south coast are mappable; and (4) areas covered with new and residual snow can be mapped, and the appearance of newly fallen snow on ERTS-1, MSS band 7 appears dark where it is melting. ERTS-1 imagery provides a means of updating various types of maps of Iceland and will permit the compilation of special maps specifically aimed at those dynamic environmental phenomena which impact on the Icelandic economy. Author

N73-28242* Gregory Geoscience Ltd., Ottawa (Ontario).
PRELIMINARY ASSESSMENT OF GEOLOGICAL APPLICATIONS OF ERTS-1 IMAGERY FROM SELECTED AREAS OF THE CANADIAN ARCTIC
Alan F. Gregory *In* NASA. Goddard Space flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 329-343 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(PAPER-G11) CSCL 08G

An assessment of geological applications of ERTS-1 imagery from selected areas of the Canadian Arctic is presented. The three levels of interpretation which may be recognized and employed to derive information from a single image or data format are outlined. It is stated that one immediate benefit from ERTS will be improved efficiency in planning for and operation of programs of regional geological mapping. Imagery of various areas of Canada are presented to show applications to regional mapping. Author

N73-28243* Earth Satellite Corp., Washington, D.C.
EXPLOITATION OF ERTS-1 IMAGERY UTILIZING SNOW ENHANCEMENT TECHNIQUES
Frank J. Wobber and Kenneth R. Martin *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 345-351 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G12) CSCL 08L

Photogeological analysis of ERTS-simulation and ERTS-1 imagery of snowcovered terrain within the ERAP Feather River site and within the New England (ERTS) test area provided new fracture detail which does not appear on available geological maps. Comparative analysis of snowfree ERTS-1 images has demonstrated that MSS Bands 5 and 7 supply the greatest amount of geological fracture detail. Interpretation of the first snow-covered ERTS-1 images in correlation with ground snow depth data indicates that a heavy blanket of snow (more than 9 inches) accentuates major structural features while a light 'dusting', (less than 1 inch) accentuates more subtle topographic expressions. An effective mail-based method for acquiring timely ground-truth (snowdepth) information was established and provides a ready correlation of fracture detail with snow depth so as to establish the working limits of the technique. The method is both efficient and inexpensive compared with the cost of similarly scaled direct field observations. Author

N73-28244* Geological Survey, Denver, Colo.
MAPPING QUATERNARY LANDFORMS AND DEPOSITS IN THE MIDWEST AND GREAT PLAINS BY MEANS OF ERTS-1 MULTISPECTRAL IMAGERY
Roger B. Morrison *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 353-361 ERTS (For availability see N73-28207 19-13)
(Paper-G13) CSCL 08B

ERTS-1 multispectral images are proving effective for differentiating many kinds of Quaternary surficial deposits and landforms units in Illinois, Iowa, Missouri, Kansas, Nebraska, and South Dakota. Examples of features that have been distinguished are: (1) the more prominent end moraines of the last glaciation; (2) certain possible palimpsests of older moraines mantled by younger deposits; (3) various abandoned river valleys, including suspected ones deeply filled by deposits; (4) river terraces; and (5) some known faults and a few previously unmapped lineaments that may be faults. The ERTS images are being used for systematic mapping of Quaternary landforms and deposits in about 20 potential study areas. Some study areas, already well mapped, provide checks on the reliability of mapping from the images. For other study areas, previously mapped only partly or not at all, our maps will be the first comprehensive, synoptic ones, and should be useful for regional land-use planning and ground-water, engineering-geology, and other environmental applications. Author

N73-28245* Wyoming Univ., Laramie.
GLACIATION OF NORTHWESTERN WYOMING INTERPRETED FROM ERTS-1
Roy M. Breckenridge *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 363-369 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G14) CSCL 08L

Analysis of ERTS Imagery has shown a number of alpine glacial features can be recognized and mapped successfully. Although the Wyoming mountains are generally regarded as the type locality for Rocky Mountain glaciation some areas have not been studied from a glacial standpoint because of inaccessibility or lack of topographic control. ERTS imagery provides an excellent base for this type of regional geomorphic study. A map of maximum extent of Wisconsin Ice, flow directions and major glacial features was compiled from interpretation of the ERTS imagery. Features which can be mapped are large moraines, outwash fans and terraces. Present-day glaciers and snowfields are easily discriminated and mapped. Glaciers and glacial deposits which serve as aquifers play a significant role in the hydrologic cycle and are important because of the increasing demand placed on our water resources. ERTS provides a quick and effective method for change detection and inventory of these vital resources. Author

N73-28246* Missouri Geological Survey and Water Resources, Rolla.
FIRST LOOK ANALYSIS OF GEOLOGIC GROUND PATTERNS ON ERTS-1 IMAGERY OF MISSOURI
William H. Allen, James A. Martin, and David L. Rath *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 371-378 refs ERTS (For availability see N73-28207 19-13)
(Paper-G15) CSCL 08G

Examination of ERTS-1 data for selected areas of Missouri revealed not only many of the known geologic features but also a number of unknown linear, circular and arcuate ground patterns. The number of new geologic elements that have been brought to light as well as the sharp definition and probable extensions of several known geologic features point out the importance of multispectral imagery via satellite and the synoptic views which they provide. To date, analysis and interpretations have been a first-look visual examination of the unenhanced projected images. Author

N73-28247* Environmental Research Inst. of Michigan, Ann Arbor.
RATIO MAPS OF IRON ORE DEPOSITS ATLANTIC CITY DISTRICT, WYOMING
Robert K. Vincent *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 379-386 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21783)
(Paper-G16) CSCL 08B

Preliminary results of a spectral rationing technique are shown for a region at the southern end of the Wind River Range, Wyoming. Digital ratio graymaps and analog ratio images have been produced for the test site, but ground truth is not yet available for thorough interpretation of these products. ERTS analog ratio images were found generally better than either ERTS single-channel images or high altitude aerial photos for the discrimination of vegetation from non-vegetation in the test site region. Some linear geological features smaller than the ERTS spatial resolution are seen as well in ERTS ratio and single-channel images as in high altitude aerial photography. Geochemical information appears to be extractable from ERTS data. Good preliminary quantitative agreement between ERTS-derived ratios and laboratory-derived reflectance ratios of rocks and minerals encourage plans to use lab data as training sets for a simple ratio gating logic approach to automatic recognition maps. Author

N73-28248* Geological Survey, Washington, D.C.
USE OF ERTS-1 IMAGES IN THE SEARCH FOR PORPHYRY COPPER DEPOSITS IN PAKISTANI BALUCHISTAN
Robert G. Schmidt *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 387-394 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G17) CSCL 08I

Geomorphic features related to a known porphyry copper deposit at Saindak, western Chagai District, Pakistan, are easily distinguished on ERTS-1 images. New geologic information from the images was used in conjunction with known geology to evaluate one previously known prospect area and to suggest two additional ones, but no new prospects were recognized on the basis of the images alone. The study also showed that Saindak-type deposits are not likely to be present in some extensive areas of the Chagai District. The Saindak deposit is in an area of relatively easily eroded folded sedimentary and volcanic rocks. The deposit is characterized by an elongate zone of easily eroded sulfide-rich rock surrounded by this rim and the central sulfide-rich valley are conspicuous features on the images. Swarms of dikes are probably useful for distinguishing real rims from other resistant rock types, but there is no expression of them on the image, although they are easily seen on aerial photographs of the Saindak rim. Author

N73-28249* Stanford Univ., Calif. Dept. of Geology.
RELATION OF ERTS-1 DETECTED GEOLOGIC STRUCTURE TO KNOWN ECONOMIC ORE DEPOSITS
Ernest I. Rich *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 395-402 refs Original Contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G18) CSCL 08G

A preliminary analysis of ERTS-1 imagery of the Northern Coast Ranges and Sacramento Valley, California, has disclosed a potentially important fracture system which may be one of the controlling factors in the location of known mercury deposits in the Coast Ranges and which appears to be associated with some of the oil and gas fields within the Sacramento Valley. Recognition of this fracture system may prove to be an extremely useful exploration tool, hence careful analysis of subsequent ERTS imagery might delineate areas for field evaluation. Author

N73-28250* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PRELIMINARY GEOLOGIC INVESTIGATIONS IN THE COLORADO PLATEAU USING ENHANCED ERTS IMAGES
Alexander F. H. Goetz, Fred C. Billingsley, Donald Elston ((Geol. Surv., Flagstaff, Ariz.), Ivo Luccitta (Geol. Surv., Flagstaff, Ariz.), and Eugene M. Shoemaker (Calif. Inst. of Tech., Pasadena) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained form the ERTS-1, Vol. 1, Sect. A and B 1973 p 403-411 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G19) CSCL 08G

Bulk and computer enhanced frames of the Verde Valley region of Central Arizona, have been analyzed for structural information and rock unit identification. Most major rock units in areas of sparse ground cover are identifiable on enhanced false-color composites. Regional structural patterns are strikingly visible on the ERTS images. New features have been identified which will aid in the search for ground water near Flagstaff, Sedona and Stewart Ranch. Author

N73-28251* Geological Survey, Washington, D.C.
STRUCTURAL GEOLOGIC ANALYSIS OF NEVADA USING ERTS-1 IMAGES: A PRELIMINARY REPORT
Lawrence C. Rowan and Pamela H. Wetlaufer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 413-423 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G20) CSCL 08G

Structural analysis of Nevada using ERTS-1 images showns several previously unrecognized lineaments which may be the surface manifestations of major fault or fracture zones. Principle trends are NE, NW, NNE-NNW, and ENE. Two lineament zones, the Walker Lane and Midas Trench lineament system, transect the predominantly NNE-NNW trending mountain ranges for more than 500 km. 50 circular features have been delineated. Comparison with known Tertiary volcanic centers and reference to geologic maps suggest 8 new centers. Preferred distribution of mines and Tertiary volcanic centers along some of the major lineament suggests a genetic relationship. The intersection of three previously unmapped lineaments in northwestern Nevada is the location of a highly productive metallogenic district. In the Walker Lane, ENE-trending lineament appear to be related to the occurrence of productive ore deposits. Author

N73-28252* Argus Exploration Co., Newport Beach, Calif.
REGIONAL TECTONIC CONTROL OF TERTIARY MINERALIZATION AND RECENT FAULTING IN THE SOUTHERN BASIN-RANGE PROVINCE, AN APPLICATION OF ERTS-1 DATA
I. C. Bechtold, M. A. Liggett, and J. F. Childs *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 425-432 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G21) CSCL 08G

Research based on ERTS-1 MSS imagery and field work in the southern Basin-Range Province of California, Nevada and Arizona has shown regional tectonic control of volcanism, plutonism, mineralization and faulting. This paper covers an area centered on the Colorado River between 34 15′ N and 36 45′ N. During the mid-Tertiary, the area was the site of plutonism and genetically related volcanism fed by fissure systems now exposed as dike swarms. Dikes, elongate plutons, and coeval normal faults trend generally northward and are believed to have resulted from east-west crustal extension. In the extensional province, gold silver mineralization is closely related to Tertiary igneous activity. Similarities in ore, structural setting, and rock types define a metallogenic district of high potential for exploration. The ERTS imagery also provides a basis for regional inventory of small faults which cut alluvium. This capability for efficient regional surveys of Recent faulting should be considered in land use planning, geologic hazards study, civil engineering and hydrology. Author

N73-28253* Rockwell International Science Center, Thousand Oaks, Calif.
ERTS APPLICATIONS IN EARTHQUAKE RESEARCH AND MINERAL EXPLORATION IN CALIFORNIA
Monem Abdel-Gawad and Joel Silverstein *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 433-450 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G22) CSCL 08E

Examples that ERTS imagery can be effectively utilized to identify, locate, and map faults which show geomorphic evidence of geologically recent breakage are presented. Several important faults not previously known have been identified. By plotting epicenters of historic earthquakes in parts of California, Sonora, Mexico, Arizona, and Nevada, we found that areas known for historic seismicity are often characterized by abundant evidence of recent fault and crustal movements. There are many examples of seismically quiet areas where outstanding evidence of recent fault movements is observed. One application is clear: ERTS-1 imagery could be effectively utilized to delineate areas susceptible to earthquake recurrence which, on the basis of seismic data alone, may be misleadingly considered safe. ERTS data can also be utilized in planning new sites in the geophysical network of fault movement monitoring and strain and tilt measurements. Author

N73-28254* Alaska Univ., Fairbanks. Geophysical Inst.
SOME ASPECTS OF ACTIVE TECTONISM IN ALASKA AS SEEN ON ERTS-1
Larry D. Gedney and James D. VanWormer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 451-457 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G23)

ERTS-1 imagery is proving to be exceptionally useful in delineating structural features in Alaska which have never been recognized on the ground. Previously unmapped features such as seismically active faults and major structural lineaments are especially evident. Among the more significant results of this investigation is the discovery of an active strand of the Denali fault. The new fault has a history of scattered seismicity and was the scene of a magnitude 4.8 earthquake on October 1, 1972. Perhaps of greater significance is the disclosure of a large scale conjugate fracture system north of the Alaska Range. This fracture system appears to result from compressive stress radiating outward from around the outside of the great bend of the Alaska Range at Mt. McKinley. Author

N73-28255* Geological Survey, Washington, D.C.
ERTS-1 IMAGE CONTRIBUTES TO UNDERSTANDING OF GEOLOGIC STRUCTURES RELATED TO MANAGUA EARTHQUAKE, 1972
W. D. Carter and G. P. Eaton *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 459-471 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G24) CSCL 08G

ERTS-1 imaged the western portion of Nicaragua on December 24, 1972, one day after the central part of the city of Managua was devastated by a major earthquake which measured 5.6 on the Richter scale. ERTS-1 images reveal sets of lineaments (which may reflect fault systems) along any one of which movement could have taken place. One set includes a line of active volcanoes that parallels the coast and constitutes the southwestern edge of the Nicaraguan Depression, a regional graben which cuts obliquely across the Central American isthmus. This trend is offset approximately 10km in a right lateral geometric sense just west of the city of Managua. A parallel lineament, north of Lake Managua, marks the northeast edge of the graben. A second set, extends northward to nowthwestward from the mouth of the Rio Grande (Viejo) north of Lake Managua and can be projected southward across the lake to Managua. It is

this set along which geometric offset of the volcanic lineament appears to have taken place. Author

N73-28256* Purdue Univ., Lafayette, Ind.
RECOGNITION OF SURFACE LITHOLOGIC AND TOPOGRAPHIC PATTERNS IN SOUTHWEST COLORADO WITH ADP TECHNIQUES
Wilton N. Melhorn and Scott Sinnock *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 473-481 refs ERTS (For availability see N73-28207 19-13)
(Paper-G25) CSCL 08M

Analysis of ERTS-1 multispectral data by automatic pattern recognition procedures is applicable toward grappling with current and future resource strasses by providing a means for refining existing geologic maps. The procedures used in the current analysis already yield encouraging results toward the eventual machine recognition of extensive surface lithologic and topographic patterns. Automatic mapping of a series of hogbacks, strike valleys, and alluvial surfaces along the northwest flank of the San Juan Basin in Colorado can be obtained by minimal man-machine interaction. The determination of causes for separable spectral signatures is dependent upon extensive correlation of micro- and macro field based ground truth observations and aircraft underflight data with the satellite data. Author

N73-28257* Johannesburg Consolidated Investment Co. Ltd., Randfontein (Republic of South Africa). Geological Research Dept.
ERTS-1 IMAGERY AS AN AID TO THE DEFINITION OF THE GEOTECTONIC DOMAINS OF THE SOUTHERN AFRICAN CRYSTALLINE SHIELD
Morris J. Viljoen and Richard P. Viljoen *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 483-491 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G26) CSCL 08G

Portions of two geotectonic environments in South Africa have been studied on ERTS-1 imagery. It was found that the broad synoptic view provided by this imagery is ideally suited to a study of the diagnostic macro-structures, and that the different geotectonic styles are clearly recorded. ERTS-1 imagery thus allows a more accurate definition than exists at present of the contact zones and internal structures of the two domains. The importance of this investigation as an aid to gaining an insight into the relevance of plate tectonics in Precambrian times is briefly discussed. Author

N73-28258* Ludwig-Maximilians-Universitat, Munich (West Germany). Zentalstelle fuer Geo-Photogrammetrie und Fernerkundung.
NEW ASPECTS ON THE TECTONIC OF THE ALPS AND THE APENNINES REVEALED BY ERTS-1 DATA
J. Bodechtel and B. Lammerer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 493-499 refs ERTS (For availability see N73-28207 19-13)
(Paper-G27) Avail: NTIS CSCL 08E

An analysis of the tectonic situation in the Alps and Apennine Mountains based on ERTS-1 imagery is presented. It is stated that the ERTS-1 imagery reveals connections between shearing systems of more than regional importance which could not be determined previously. The tracing of locally known fault distances by ERTS-1 imagery is discussed. Author

N73-28259* Steffensen (Roberto), Ottawa (Ontario).
STRUCTURAL LINEAMENTS OF GASPE FROM ERTS IMAGERY
Roberto Steffensen *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 501-515 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 51198 ERTS (For availability see N73-28207 19-13)
(Paper-G28) CSCL 08G

A test study was conducted to assess the value of ERTS images for mapping geologic features of the Gaspe Peninsula, Quebec. The specific objectives of the study were: 1) to ascertain the best procedure to follow in order to obtain valuable geologic data as a result of interpretation; and 2) to indicate in which way these data could relate to mineral exploration. Of the four spectral bands of the MultiSpectralScanner, the band from 700 to 800 nanometers, which seems to possess the best informational content for geologic study, was selected for analysis. The original ERTS image at a scale of 1:3,700,000 was enlarged about 15 times and reproduced on film. Geologically meaningful lines, called structural lineaments, were outlined and classified according to five categories: morpho-lithologic boundaries, morpho-lithologic lineaments, fault traces, fracture zones and undefined lineaments. Comparison with the geologic map of Gaspe shows that morpho-lithologic boundaries correspond to contacts between regional stratigraphic units. Morpholithologic lineaments follow bedding trends, whereas fracture traces appear as sets of parallel lineaments, intersecting at high angles the previous category of lineaments. Fault traces mark more precisely the location of faults already mapped and spot the presence of presumable faults, not indicated on the geologic map. Author

N73-28260* Geological Survey, Washington, D.C.
LINEAMENTS IN COASTAL PLAIN SEDIMENTS AS SEEN IN ERTS IMAGERY
Charles F. Withington *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 517-521 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G29) CSCL 08J

Examination of satellite imagery over the Atlantic Coastal Plain near Washington, D. C. shows numerous lineaments, which cannot be accounted for by any known cultural or natural features. At least some of these lineaments represent the surface expression of faults, for one of them has been correlated with the outcrop of a fault that had been traced for several miles in southern Prince Georges County, Maryland. If a substantial number of these lineaments do indeed represent fault traces, the fact that they show on the surface suggests that the geologic history of the Coastal Plain is much more complex than has previously been recognized, and that faulting may have occurred in the Holocene, much later than has generally been recognized. The importance that such recent movements could have on future development of the Coastal Plain should be emphasized. Author

N73-28261* Texas Instruments, Inc., Dallas.
EVALUATION OF COMMERCIAL UTILITY OF ERTS-A IMAGERY IN STRUCTURAL RECONNAISSANCE FOR MINERALS AND PETROLEUM
Donald F. Saunders and Gilbert E. Thomas *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 523-530 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G30) CSCL 08G

Five areas in North America (North Slope-Alaska, Superior Province-Canada, Williston Basin-Montana, Colorado and New Mexico-West Texas) are being studied for discernibility of geological evidence on ERTS-1 imagery. Evidence mapped is compared with known mineral/hydrocarbon accumulations to determine the value of the imagery in commercial exploration programs. Evaluation has proceeded in the New Mexico-West Texas area while awaiting imagery in the other areas. To date, results have been better than expected. Clearly discernible structural lineaments in New Mexico-West Texas are evident on the photographs. Comparison of this evidence with known major mining localities in New Mexico indicates a clear pattern of coincidence between the lineaments and mining localities. In West Texas, lineament and geomorphological evidence obtainable from the photographs define the petroleum-productive Central Basin Platform. Based on evaluation results in the New Mexico-West Texas area and on cursory results in the other four areas of North America, ERTS-1 imagery will be extremely valuable in defining the regional and local structure in any commercial exploration program. Author

N73-28262* Iowa Univ., Iowa City. Dept. of Geography.
STRUCTURAL INTERPRETATIONS BASED ON ERTS-1 IMAGERY, BIGHORN REGION, WYOMING-MONTANA
Richard A. Hoppin *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 531-538 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G31) CSCL 08E

Structural analysis is being carried out on bands MSS 5 and 7 of scene 1085-17294. Geologic structure is primarily revealed in the topographic relief and drainage. Topographic linears are particularly well developed in the bighorn uplift. Many of these occur along known faults and shear zones in the Precambrian core; several have not been previously mapped. These linears, however, do not continue into the younger rocks of the flanks or do so in a much less marked manner than in the core. Linears are far less abundant in the basin or are manifested only in very subtle tonal contrasts and somewhat straight drainage segments. Some of the linears are aligned along trends previously postulated on the basis of surface mapping to be lineaments. The imagery reveals little or no evidence of strike-slip displacements along these lineaments. Author

N73-28263* Montana Univ., Missoula.
APPLICABILITY OF ERTS-1 TO LINEAMENT AND PHOTOGEOLOGIC MAPPING IN MONTANA: PRELIMINARY REPORT
Robert M. Weidman, David D. Alt, Raymond E. Flood, Katherine T. Hawley, Linda K. Wackwitz, Richard B. Berg (Mont. Bur. of Mines and Geol.), and Willis M. Johns (Mont. Bur. of Mines and Geol.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 539-546 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G32) CSCL 08B

A lineament map prepared from a mosaic of western Montana shows about 85 lines not represented on the state geologic map, including elements of a northeast-trending set through central western Montana which merit ground truth checking and consideration in regional structural analysis. Experimental fold annotation resulted in a significant local correction to the state geologic map. Photogeologic mapping studies produced only limited success in identification of rock types, but they did result in the precise delineation of a late Cretaceous or early Tertiary volcanic field (Adel Mountain field) and the mapping of a connection between two granitic bodies shown on the state map. Imagery was used successfully to map clay pans associated with bentonite beds in gently dipping Bearpaw Shale. It is already apparent that ERTS imagery should be used to facilitate preparation of a much needed statewide tectonic map and that satellite imagery mapping, aided by ground calibration, provides and economical means to discover and correct errors in the state geologic map. Author

N73-28264* California Univ., Riverside. Dept. of Geography.
A NEW FAULT LINEAMENT IN SOUTHERN CALIFORNIA
Robert W. Pease and Claude W. Johnson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 547-552 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-G33) CSCL 08E

ERTS-1 imagery clearly shows a 50-mile wide tectonic zone across Southern California oriented about 15 deg to the structures of the Transverse Ranges or with an azimuth of 70 deg. The zone is delineated on the imagery by terrian alignments and vegetational differences. A previously undisclosed tectonic lineament extends across the Mojave Desert and appears as a line of crustal upwarping. Pressure which would have caused this plus the occurrence of many thrust faults with the 70 deg azimuth indicate this to be a zone of curstal compression. Recent earthquake epicenters appear to be related to this compression zone rather than the traditional fault network of Southern California. Author

N73-28265* Indiana Geological Survey, Bloomington.
FRACTURE MAPPING AND STRIP MINE INVENTORY IN THE MIDWEST BY USING ERTS-1 IMAGERY
Charles W. Wier, Frank J. Wobber (Earth Satellite Corp., Washington), Orville R. Russell, and Roger V. Amato (Earth Satellite Corp., Washington) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 553-560 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E1)

Analysis of the ERTS-1 imagery and high-altitude infrared photography indicates that useful fracture data can be obtained in Indiana and Illinois despite a glacial till cover. ERTS MSS bands 5 and 7 have proven most useful for fracture mapping in coal-bearing rocks in this region. Preliminary results suggest a reasonable correlation between image-detected fractures and mine roof-fall accidents. Information related to surface mined land, such as disturbed area, water bodies, and kind of reclamation, has been derived from the analysis of ERTS imagery. Author

N73-28266* Bendix Corp., Ann Arbor, Mich.
ERTS-1 INVESTIGATION OF ECOLOGICAL EFFECTS OF STRIP MINING IN EASTERN OHIO
Philip E. Chase and Wayne Pettyjohn (Ohio State Univ.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B. 1973 p 561-568 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E2) CSCL 08I

Evidence is presented of ERTS capability to detect, map and monitor the effects of strip mining. Both enlarge ERTS imagery and statistically processed outline maps and imagery of stripped earth and standing water are compared to aerial photos of a strip mine near Coshocton, Ohio. The outline maps and decision imagery are at present limited to forming a disruption map of recently mined and unreclaimed earth and the resultant standing water within the mined area. It is planned to prepare a map of the reclaimed areas (reclamation map) within the stripped area and to detect and identify ecological effects such as vegetation kills and stream sedimentation external to the stripped areas. Author

N73-28267* Pennsylvania State Univ., University Park. Office of Remote Sensing of Earth Resources.
THE USE OF ERTS-1 MSS DATA FOR MAPPING STRIP MINES AND ACID MINE DRAINAGE IN PENNSYVANIA
S. S. Alexander, J. Dein, and D. P. Gold *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 569-575 refs erts (For availability see N73-28207 19-13)
(Paper-E3) CSCL 08I

Digital processing of ERTS-I MSS data for areas around the west branch of the Susquehanna River permits identification of stripped areas including ones that are not discernible from visual analysis of ERTS imagery. Underflight data and ground-based observations are used for ground-truth and as a basis for designing more refined operators to make sub-classifications of stripped areas, particularly with regard to manifestations of acid mine drainage; because of associated diagnostic effects on vegetation, seasonal changes in classifiction criteria are being documented as repeated, cloud-free ERTS-I coverage of the same area becomes available. Preliminary results indicate that ERTS data can be used to monitor not only the total extent of stripping in given areas but also the effectiveness of reclamation and pollution abatement procedures. Author

N73-28268* Spectral Africa (Pty) Ltd., Randfontein (Republic of South Africa).
MONITORING VEGETATION COVER ON MINE DUMPS WITH ERTS-1 IMAGERY: SOME INITIAL RESULTS
Brian Gilbertson *In* NASA. Goddard Space Flight Center Symp.

on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 577-584 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E4) CSCL 08I

ERTS-1 imagery is being used in an attempt to differentiate between mine dumps having varying degrees of vegetative cover. At this stage it is clear that the various mine dumps can be located and identified. Differences in vegetative cover can be seen and measured. Patterns of vegetative growth, some characteristic to particular dumps, can also be seen. It is therefore tentatively concluded that mine dumps can be differentiated with respect to their vegetative cover on the imagery received to date. Subsequent imagery showing seasonal variations should facilitate this program. Author

N73-28269* Old Dominion Univ., Norfolk, Va. Dept. of Geophysical Sciences.
REMOTE DETECTION OF AEROSOL POLLUTION BY ERTS
G. E. Copeland, A. R. Brandy, E. C. Kindle, R. N. Blais, and G. M. Hilton *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 585-592 ERTS (For availability see N73-28207 19-13)
(Paper-E5) CSCL 04B

Photogrammetric and densitometric examination of ERTS-1 MSS imagery of Eastern Virginia coupled with extensive ground truth air quality and meteorological data has shown that the identification and surveying of fixed particulate emitters (smoke plumes) is feasible. A description of the ground truth network is included. The quantitative monitoring of smoke stacks from orbital altitudes over state size regions appears possible when tied to realistic plume models and minimal ground truth. Contrast reductions over urban areas can possibly be utilized to produce isopleths of particulates when supplemented by local measurements. Author

N73-28270* Forest Management Inst., Ottawa (Ontario).
DETECTION, MAPPING AND ESTIMATION OF RATE OF SPREAD OF GRASS FIRES FROM SOUTHERN AFRICAN ERTS-1 IMAGERY
J. M. Wightman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B Original contains imagery. Original photography may be purchased from EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E6) CSCL 08B

Sequential band-6 imagery of the Zambesi Basin of southern Africa recorded substantial changes in burn patterns resulting from late dry season grass fires. One example from northern Botswana, indicates that a fire consumed approximately 70 square miles of grassland over a 24-hour period. Another example from western Zambia indicates increased fire activity over a 19-day period. Other examples clearly define the area of widespread grass fires in Angola, Botswana, Rhodesia and Zambia. From the fire patterns visible on the sequential portions of the imagery, and the time intervals involved, the rates of spread of the fires are estimated and compared with estimates derived from experimental burning plots in Zambia and Canada. It is concluded that sequential ERTS-1 imagery, of the quality studied, clearly provides the information needed to detect and map grass fires and to monitor their rates of spread in this region during the late dry season. Author

N73-28271* American Univ., Washington, D.C. Dept. of Biology.
MAPPING ATLANTIC COASTAL MARSHLANDS, MARYLAND, GEORGIA, USING ERTS-1 IMAGERY
Richard R. Anderson, Virginia Carter, and John McGinness *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 603-613 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E7) CSCL 08H

Eastern coastal marshes are the most extensive and productive in the United States. A relatively low cost, moderately accurate method is needed to map these areas for management and protection. Groundbased and low-altitude aircraft methods for mapping are time-consuming and quite expensive. The launch of NASA's Earth Resources Technology Satellite has provided an opportunity to test the feasibility of mapping wetlands using small scale imagery. The test sites selected were in Chesapeake Bay, Maryland, and Ossabaw Island, Georgia. Results of the investigation indicate that the following may be ascertained from ERTS imagery, enlarged to 1:250,000: (1) upper wetland boundary; (2) drainage pattern in the wetland; (3) plant communities; (4) ditching activities associated with agriculture; and (5) lagooning for water-side home development. Conclusions are that ERTS will be an excellent tool for many types of coastal wetland mapping. Author

N73-28272* Delaware Univ., Newark. Coll. of Marine Studies.
IDENTIFICATION OF MARSH VEGETATION AND COASTAL LAND USE IN ERTS-1 IMAGERY
V. Klemas, F. Daiber, and D. Bartlett *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 615-627 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21837; Grants NSF GI-33369; NOAA-GH-109)
(Paper-E8) CSCL 08H

Coastal vegetation species appearing in the ERTS-1 images taken of Delaware Bay on August 16, and October 10, 1972 have been correlated with ground truth vegetation maps and imagery obtained from high altitude RB-57 and U-2 overflights. The vegetation maps of the entire Delaware Coast were prepared during the summer of 1972 and checked out with ground truth data collected on foot, in small boats, and from low-altitude aircraft. Multispectral analysis of high altitude RB-57 and U-2 photographs indicated that five vegetation communities could be clearly discriminated from 60,000 feet altitude including: (1) salt marsh cord grass, (2) salt marsh hay and spike grass, (3) reed grass, (4) high tide bush and sea myrtle, and (5) a group of fresh water species found in impoundments built to attract water fowl. All of these species are shown in fifteen overlay maps, covering all of Delaware's wetlands prepared to match the USGS topographic map size of 1:24,000. Author

N73-28273* Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT
Robert L. Mairs, Frank J. Wobber, Donald Garofalo, and Roland Yunghans (N. J. Dept. of Environ. Protection) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1 Sect. A and B 1973 p 628-634 ERTS (For availability see N73-28207 19-13)
(Paper-E9) CSCL 08A

ERTS-1 imagery is being used by the New Jersey Department of Environmental Protection (NJDEP) to develop information products that will assist the state in optimally managing its coastal resources and in allocating funds. Interviews with NJDEP personnel have identified significant problem areas in the coastal zone, and the types of remote sensor derived information products that can be used in real-time decision making. Initial analyses of imagery from several successive ERTS-1 orbits have shown the extent, predominant drift, and dispersion characteristics of waste disposal in coastal New Jersey waters. Imagery (MSS Bands 4 and 5) for several orbits, shows that New-York Harbor tidal discharge extending as far south as Long Branch, New Jersey. Author

N73-28274* Environmental Research Inst. of Michigan, Ann Arbor.
MONITORING OCEAN DUMPING WITH ERTS-1 DATA
C. T. Wezernak and N. Roller *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1 Vol. 1, Sect. A and B 1973 p 635-641 refs Original contains imagery. Original photography may be purchased from

the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E10) CSCL 08A

The results of an analysis of ERTS-1 data for the New York Bight collected on 16 August 1972 are described. Results are presented which show acid-iron wastes, sewage sludge, suspended solids, and major water mass boundary features in the study area. The potential of satellite remote sensing for monitoring large scale events such as ocean dumping is discussed. Author

N73-28275* Vermont Univ., Burlington.
ENVIRONMENTAL STUDY OF ERTS-1 IMAGERY: LAKE CHAMPLAIN AND VERMONT
Aulis O. Lind, E. Bennette Henson, and James Pelton *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 643-650 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E11) CSCL 08F

Environmental concerns of the State of Vermont currently being stressed include water quality in Lake Champlain and a state-wide land use and capability plan. Significant results obtained from ERTS-1 relate directly to the above concerns. Industrial water pollution and turbidity in Lake Champlain have been identified and mapped and the ERTS pollution data will be used in the developing court suit which Vermont has initiated against the polluters. ERTS imagery has also provided a foundation for updating and revising land use inventories. Major classes of land use have been identified and mapped, and substantial progress has been made toward the mapping of such land use divisions as crop and forest type, and wetlands. Author

N73-28276* Kansas Univ., Lawrence.
WATER TURBIDITY DETECTION USING ERTS-1 IMAGERY
Harold L. Yarger, James R. McCauley, Gerard W. James, Larry M. Magnuson, and G. Richard Marzolf (Kansas State Univ.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 651-658 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21822)
(Paper-E12) CSCL 08H

ERTS-1 images of two federal reservoirs in Kansas exhibit good correlation with suspended load. The major reservoirs in Kansas, as well as in other Great Plains states, are playing increasingly important roles in flood control, recreation, agriculture, and urban water supply. Satellite imagery may prove useful for acquiring timely low cost water quality data required for optimum management of these fresh water resources. Author

N73-28277* American Univ., Washington, D.C. Dept. of Biology.
DIGITAL ANALYSIS OF POTOMAC RIVER BASIN ERTS IMAGERY: SEDIMENTATION LEVELS AT THE POTOMAC-ANACOSTIA CONFLUENCE AND STRIP MINING IN ALLEGHENY COUNTY, MARYLAND
J. S. Schubert and N. H. MacLeod *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 659-664 ERTS (For availability see N73-28207 19-13)
(Paper-E13) CSCL 08H

Two simple algorithms for classification of sedimentation levels in water and for delineation of active strip mines are in use as part of the development of a more general resource management information system. ERTS MSS CCT's are processed so that each pixel in each channel is geographically referenced and can be accessed individually during whole frame, multi-channel analysis or partial frame analysis. The sedimentation analysis clearly separates classes representing the turbid Anacostia water, the less disturbed Potomac (really), and mud flats resulting from effluent of a major sewage treatment plant. Mud flats of organic or mineral origin are easily distinguished. Author

N73-28278* Tokyo Univ. (Japan). Inst. of Industrial Science.
A STUDY ON THE EROSION OF NIIGATA BEACH FROM ERTS-A IMAGERY
Takakazu Maruyasu *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 665-672 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E14A) CSCL 08H

Coastal erosion of Niigata Beach, Japan as a result of construction works is discussed. The application of ERTS-1 imagery for defining and monitoring the extent of the erosion is described. The contribution of ERTS-1 data to studies leading to effective erosion control methods are reported. Author

N73-28279* Japan Meteorological Agency, Tokyo.
APPLICATION OF ERTS DATA TO THE DETECTION OF THIN CIRRUS AND CLEAR AIR TURBULENCE
Kiyoshi Tsuchiya and Toshiro Kamiko (Tokyo Intern. Air Weather Service) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 673-680 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E14B) CSCL 04B

The feasibility of detecting a thin cirrus and clear air turbulence from ERTS MSS data is explored. The result of analyses indicates that a thin cirrus not shown in conventional meteorological satellite picture can be revealed in ERTS MSS picture. It is also found that the core of jet stream can be located with high accuracy from ERTS pictures and the possible area of clear air turbulence can be predicted if the data of the quality of ERTS data are available in real time. Author

N73-28280* Kyoto Univ. (Japan).
POLLUTED AND TURBID WATER MASSES IN OSAKA BAY AND ITS VICINITY REVEALED WITH ERTS-A IMAGERIES
Kantaro Watanabe *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 681-687 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-E14C) CSCL 08A

ERTS-1 took very valuable MSS imageries of Osaka Bay and its vicinity on October 24, 1972. In the MSS-4 and MSS-5 imageries a complex grey pattern of water masses can be seen. Though some of grey colored patterns seen in black and white prints of the MSS-4 and MSS-5 imageries are easily identified from their shapes as cloud covers or polluted water masses characterized by their color tone in longer wavelengths in the visible region, any correct distribution pattern of polluted or turbid water masses can be hardly detected separately from thin cloud covers in a quick look analysis. In the present investigation, a simple photographic technique was applied using the fact that reflected sun light from cloud including smog and inclined water surfaces of wave have a certain component in the near infrared region, that MSS-7, whereas the light scattered from fine materials suspended in the sea water has nearly no component sensible in MSS-4 and MSS-5 channels. Author

N73-28281* Geological Survey, Washington, D.C.
HYDROGEOLOGY OF CLOSED BASINS AND DESERTS OF SOUTH AMERICA, ERTS-1 INTERPRETATIONS
George E. Stoertz and William D. Carter *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 695-705 refs ERTS (For availability see N73-28207 19-13)
(Paper-W1) CSCL 08H

Images from the Earth Resources Technology Satellite (ERTS-1) contain data useful in studies of hydrogeology, geomorphology, and paleoclimatology. Sixteen Return Beam Vidicon (RBV) images and 15 Multi-Spectral Scanner (MSS) images were studied. These covered deserts and semidesert areas in southwestern Bolivia, northwestern Argentina, northern Chile, and southeastern Peru from July 30 to November 17, 1972. During the first 3 months after launching, high-quality cloud-free imagery was obtained over approximately 90 percent of the

region of interior drainage, or an area of 170,000 square miles.
Author

N73-28282* Polytechnical Univ. of Madrid (Spain).
DETECTION OF MAJOR RIVER BED CHANGES IN THE RIVER EBRO (NORTH-EASTERN SPAIN)
R. Espejo, J. Torrent, and C. Roquero *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 707-711 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W2) CSCL 08H

The application or ERTS-1 data to determine the major river bed changes of the Ebro River in northeastern Spain is discussed. Image quality was good enough to permit a clear identification of the river course and bands MSS 5 and 7 proved to be the most useful for this purpose. Reflectance for band 5 was high due to the high sediment content of the water and sufficed to identify the river. Features like bodies of water related to old channels and depressions were only apparent in band 7. Author

N73-28283* Mekong Committee Secretariat, Bangkok (Thailand).
APPLICATIONS OF MULTISPECTRAL IMAGERY TO WATER RESOURCES DEVELOPMENT PLANNING IN THE LOWER MEKONG BASIN (KHMER REPUBLIC, LAOS, THAILAND AND VIET-NAM)
William J. vanKiere *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 713-741 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W3)

The use of ERTS imagery for water resources planning in the lower Mekong Basin relates to three major issues: (1) it complements data from areas, which have been inaccessible in the past because of security; this concerns mainly forest cover of the watersheds, and geological features, (2) it refines ground surveys; this concerns mainly land forms, and soils of existing and planned irrigation perimeters, and (3) it provides new information, which would be almost or entirely impossible to detect with ground surveys or conventional photography; this concerns the mechanism of flooding and drainage of the delta; siltation of the Great Lake and mapping of acidity, possibly also of salinity, in the lower delta; sedimentation and fisheries in the Mekong Delta estuarine areas. Author

N73-28284* Geological Survey, Denver, Colo.
ASSESSMENT OF FLOOD DAMAGE IN ARIZONA BY MEANS OF ERTS-1 IMAGERY
Roger B. Morrison and Maurice E. Cooley *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 755-760 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W6)

ERTS-1 MSS images clearly show two important effects of a large flood in southeastern Arizona - the extent of inundation and the areas affected by servere sediment deposition and erosion - although the images were made a week and a half after the flood. On October 20 and 21, 1972, the upper Gila River had its third-largest flood on record. Peak flows attained about 42,000 and 82,000 cubic feet a second at Duncan and Safford, Arizona, respectively. The first ERTS-1 images after the flood were made on November 1 and 2. The inundated area is best displayed on the infrared bands, particularly on band 7, where it appears as a belt along the river that is distinctly darker than adjoining parts of the flood plain. This dark belt does not appear on ERTS images that predate the flood. Presumably the low infrared reflectance of this belt is caused by still-moist soil and by flood-stressed vegetation. Inundation limits mapped from ERTS imagery agree well with those obtained by aerial photography during the flood and by ground surveys.
Author

N73-28285* Geological Survey, Tucson, Ariz.
USE OF THE SRI ELECTRONIC SATELLITE IMAGE ANALYSIS CONSOLE FOR MAPPING SOUTHERN ARIZONA PLANT COMMUNITIES FROM ERTS-1 IMAGERY
Raymond M. Turner *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 761-768 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W7) CSCL 05B

Cloud-free imagery covering the Tucson, Ariz., region for the period from August 22 to November 2, 1972, was used to determine the utility of ERTS-1 data for discriminating boundaries between plant communties. The following studies were made from imagery analyzed by use of an Electronic Satellite Image Analysis Console: (1) console-generated color composites from MSS-5 and MSS-6 bands were recorded photographically from the console color monitor. The color photographs were then used to compare with short-term changes in vegetative cover observed on the ground; (2) using the console, microdensitometric traces were made along selected traverses to quantify changes in scene irradiance across the image field; (3) quantitative plant coverage data, collected at ground-truth stations along the traverses, were compared with the densitometric values. Author

N73-28286* Geological Survey, Phoenix, Ariz. Water Resources Div.
MONITORING OF STREAMFLOW IN THE VERDE RIVER BY ERTS-1 DATA COLLECTION SYSTEM (DCS)
Herbert H. Schumann *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 769-776 ERTS (For availability see N73-28207 19-13)
(Paper-W8)

The Verde River watershed in central Arizona furnishes municipal, industrial, and agricultural water to the Salt River Valley --an area that contains more than half of Arizona's population and about one-fourth of the State's irrigated land. Water-management decisions related to the operation of large multiple-use reservoirs require accurate and continuous monitoring of moisture conditions over large remote areas. The U.S. Geological Survey in cooperation with the Salt River Valley Water Users' Association installed a specially designed gaging station on the Verde River near the town of Camp Verde to evaluate near-real time streamflow data furnished by the ERTS-1 Data Collection System (DCS). On Nov. 3, 1972, the installation was equipped with a Stevens digital water-level recorder, modified for telemetry, and an ERTS-1 data collection platform operating in the digital-parallel mode. Author

N73-28287* Geological Survey, Harrisburg, Pa.
PRELIMINARY ANALYSIS OF ERTS-RELAYED WATER RESOURCES DATA IN THE DELAWARE RIVER BASIN
Richard W. Paulson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Sect. A and B 1973 p 777-792 ERTS (For availability see N73-28207 19-13)
(Paper-W10) CSCL 08H

Preliminary analysis of ERTS-DCS data from water-resources stations in the Delaware River Basin indicates that the Data-Collection System is performing well. Data-Collections Platforms have been successfully interfaced with five stream-gaging station and three ground-water observation wells and are being interfaced with 12 water-quality monitors in the basin. Data are being relayed during four or five ERTS orbital passes per day, which is within the design specifications of the ERTS-DCS.
Author

N73-28288* Bureau of Sport Fisheries and Wildlife, Washington, D.C.
AN EVALUATION OF SPACE ACQUIRED DATA AS A TOOL FOR MANAGEMENT TO WILDLIFE HABITAT IN ALASKA
Bill J. VanTries *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 795-799 ERTS (For availability see N73-28207 19-13)
(Paper-W11) CSCL 06C

The Bureau of Sport Fisheries and Wildlife ERTS experiment in Alaska attempts to yield information useful for three primary functions in the State. They are: (1) to test the feasibility of using ERTS data, in conjunction with aircraft acquired multispectral photography, to develop effective stratified sampling techniques, (2) to provide near real time assessment and evaluation of the quantity, quality, and distribution of waterfowl breeding habitat through frequent ERTS measurements of hydrologic, phenological and vegetational parameters, and (3) to provide basic mapping of vegetation and terrain in certain remote areas of the State for which little or no biological data now exist. Author

N73-28289* Environmental Research Inst. of Michigan, Ann Arbor.

PRELIMINARY EVALUATION OF ERTS-1 FOR DETERMINING NUMBERS AND DISTRIBUTION OF PRAIRIE PONDS AND LAKES

Edgar A. Work, Jr., David S. Gilmer (Bur. of Sport Fisheries and Wildlife, Jamestown, N. D.), and A. T. Klett (Bur. of Sport Fisheries and Wildlife, Jamestown, N. D.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 801-808 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W12) CSCL 08H

ERTS-1 and aircraft multispectral data collected over a North Dakota test site during July 1972, are compared to evaluate the capability of the satellite sensors to detect numbers and distribution of prairie ponds and lakes. Recognition maps using ERTS-1, MSS 7 data are generated using a level slicing technique. Surface water areas larger than two acres are recognized, but ponds in the one-to two-acre range are detected only at random. The proportion estimation technique will improve the accuracy of area determination and small pond detection. Author

N73-28290* Texas Technological Univ., Lubbock. Dept. of Geosciences.

DYNAMICS OF PLAYA LAKES IN THE TEXAS HIGH PLAINS

C. C. Reeves, Jr. *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 809-817 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W13) CSCL 08H

This study shows that satellite imagery can be used for a census of the thousands of lake basins which commonly exist in semi-arid areas, and which sporadically contain water at various times of the year. Storm paths and runoff collected by such lake basins can also be closely monitored, the accuracy dependent on periodicity of the orbits and the size of the basins. Study of the relationships between spectral differences (obtained from ERTS-1 imagery) and the water balance ecosystem of the lake basins is in a preliminary stage. However, examination of ERTS-1 MSS frames show that Band 4 has the poorest tonal contrast in semi-arid West Texas, Band 5 is best for definition of vegetation, Band 6 is best for defining larger water areas, and Band 7 is best for counting small lake basins with water. Ground-truth studies reveal significant differences between test sites, the relative importance of which will be reflected by the hydrologic balance of each lake basin. Author

N73-28291* Guelph Univ. (Ontario).

STUDIES IN THE LAKE ONTARIO BASIN USING ERTS-1 AND HIGH ALTITUDE DATA

A. Falconer, S. H. Collins, W. T. Dickison, R. Protz, R. P. Bukata (Can. Centre for Inland Waters), K. P. B. Thomson (Can. Centre for Inland Waters), G. P. Harris (McMaster Univ.), and P. J. Howarth (McMaster Univ.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 819-828 refs ERTS (For availability see N73-28207 19-13)
(Paper-W14) CSCL 08H

Studies in the Lake Ontario Basin are designed to provide input for models of river basin discharge and macro-scale features of lake circulation. Lake studies appear to require high altitude imagery to record the dynamic features of Lake Ontario so that ERTS-1 data may be interpreted. Land area studies require input of soil moisture, land use and soil-sediment-geomorphology measurements some of which appear to be available, on a regional scale from ERTS-1 products. Author

N73-28292* Environmental Research Inst. of Michigan, Ann Arbor.

PROGRESS OF AN ERTS-1 PROGRAM FOR LAKE ONTARIO AND ITS BASIN

Thomas W. Wagner and Fabian C. Polcyn *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 829-836 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W15) CSCL 08H

The Lake Ontario drainage basin covers over 32,000 square miles of U.S. and Canadian territory. ERTS-1 data is contributing to the comprehensive study of this basin as part of the International Field Year for the Great Lakes (IFYGL). This paper details a processing approach for obtaining detailed and objective synoptic information thought to be applicable to terrestrial water balance studies of such a large area. A simple ratio algorithm was tested for minimizing daily variations in ERTS data and for allowing the discrimination of surface features and land use classes of hydrologic significance. These steps are necessary if ERTS data is to provide the quantitative information required for the study and management of areas of regional size. Author

N73-28293* Geological Survey, Arlington, Va.

REMOTE SENSING OF TURBIDITY PLUMES IN LAKE ONTARIO

Edward J. Pluhowski *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 837-846 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W16) CSCL 08H

Preliminary analyses of ERTS-1 imagery demonstrates the utility of the satellite to monitor turbidity plumes generated by the Welland Canal, and the Genese and Oswego Rivers. Although visible in high altitude photographs, the Niagara River plume is not readily identifiable from satellite imagery. Author

N73-28294* Wisconsin Univ., Milwaukee. Air Pollution Analysis Lab.

ERTS-1 VIEWS THE GREAT LAKES

Walter A. Lyons and Steven R. Pease *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 847-854 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21736; Grants NSF GA-32208; EPA-R-800873)
(Paper-W17) CSCL 04B

The meteorological content of ERTS images, particularly mesoscale effects of the Great Lakes and air pollution dispersion is summarized. Summertime lake breeze frontal clouds and various winter lake-effect convection patterns and snow squalls are revealed in great detail. A clear-cut spiral vortex over southern Lake Michigan is related to a record early snow storm in the Chicago area. Marked cloud changes induced by orographic and frictional effects on Lake Michigan's lee shore snow squalls are seen. The most important finding, however, is a clear-cut example of alterations in cumulus convection by anthropogenic condensation and/or ice nuclei from northern Indiana steel mills during a snow squall situation. Jet aircraft condensation trails are also found with surprising frequency. Author

N73-28295* Environmental Research and Technology, Inc., Lexington, Mass.

USE OF ERTS DATA FOR MAPPING SNOW COVER IN THE WESTERN UNITED STATES

James C. Barnes and Clinton J. Bowley *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from

the ERTS-1, Vol. 1, Sect. A and B 1973 p 855-862 refs ERTS (For availability see N73-28207 19-13)
(Paper-W18) CSCL 08L

The purpose of this investigation is to evaluate the application of ERTS data for mapping snow cover, primarily in the mountainous areas of the western United States. The specific objectives are to determine the spectral interval most suitable for snow detection, to determine the accuracy with which snow lines can be mapped in comparison with the accuracies attainable from other types of measurements, and to develop techniques to differentiate reliably between snow and clouds and to understand the effects of terrain and forest cover on snow detection. Author

N73-28296* Geological Survey, Tacoma, Wash.
EVALUATION OF ERTS IMAGERY FOR MAPPING AND DETECTION OF CHANGES OF SNOWCOVER LAND AND ON GLACIERS
Mark F. Meier *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 863-875 refs Original contains imagery. Original photography may by purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-W19) CSCL 08L

The percentage of snowcover area on specific drainage basins was measured from ERTS imagery by video density slicing with a repeatability of 4 percent of the snowcovered area. Data from ERTS images of the melt season snowcover in the Thunder Creek drainage basin in the North Cascades were combined with existing hydrologic and meteorologic observations to enable calculation of the time distribution of the water stored in this mountain snowpack. Similar data could be used for frequent updating of expected inflow to reservoirs. Equivalent snowline altitudes were determined from area measurements. Snowline altitudes were also determined by combining enlarged ERTS images with maps with an accuracy of about 60 m under favorable conditions. Ability to map snowcover or to determine snowline altitude depends primarily on cloud cover and vegetation and secondarily on slope, terrain roughness, sun angle, radiometric fidelity, and amount of spectral information available. Author

N73-28297* Georgia Univ., Athens.
CARTOGRAPHIC QUALITY OF ERTS-1 IMAGES
R. Welch *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 879-885 refs ERTS (For availability see N73-28207 19-13)
(Grant DI-14-08-0001-13167)
(Paper-L1) CSCL 08B

Analyses of simulated and operational ERTS images have provided initial estimates of resolution, ground resolution, detectability thresholds and other measures of image quality of interest to earth scientists and cartographers. Based on these values, including an approximate ground resolution of 250 meters for both RBV and MSS systems, the ERTS-1 images appear suited to the production and/or revision of planimetric and photo maps of 1:500,000 scale and smaller for which map accuracy standards are compatible with the imaged detail. Thematic mapping, although less constrained by map accuracy standards, will be influenced by measurement thresholds and errors which have yet to be accurately determined for ERTS images. This study also indicates the desirability of establishing a quantitative relationship between image quality values and map products which will permit both engineers and cartographers/earth scientists to contribute to the design requirements of future satellite imaging systems. Author

N73-28298* Geological Survey, McLean, Va.
PROGRESS IN CARTOGRAPHY, EROS PROGRAM
Alden P. Colvocoresses and Robert B. McEwen *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 887-898 refs ERTS (For availability see N73-28207 19-13)
(Paper-L2) CSCL 08B

During the past 7 years the Interior Department EROS (Earth Resources Observation Systems) program with NASA sponsorship has conducted cartographic research based on high altitude aerial and space photographs. The research has centered on the direct use of the image and its transformation into so-called photo or image maps. Today the cartographers of the Geological Survey have a real opportunity for making maps from data supplied by ERTS-1 which is dedicated to remote sensing of the earth. Author

N73-28299* Geological Survey, Washington, D.C.
CHANGE IN LAND USE IN THE PHOENIX (1:250,000) QUADRANGLE, ARIZONA BETWEEN 1970 AND 1972: SUCCESSFUL USE OF PROPOSED LAND USE CLASSIFICATION SYSTEM
John L. Place *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 899-906 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L3) CSCL 08B

Changes in land use in the Phoenix (1:250,000 scale) Quadrangle in Arizona have been mapped using only the images from ERTS-1, tending to verify the utility of a land use classification system proposed for use with ERTS images. The period of change investigated was from November 1970 to late summer or early fall, 1972. Seasonal changes also were studied using successive ERTS images. Types of equipment used to aid interpretation included a color additive viewer, a twenty-power magnifier, a density slicer, and a diazo copy machine for making ERTS color composites in hard copy. Types of changes detected have been: (1) cropland or rangeland developed for new residential areas; (2) rangeland converted to new cropland; and (3) possibly new areas of industrial or commercial development. A map of land use previously compiled from air photos was updated in this manner. Author

N73-28300* California Univ., Santa Barbara. Geography Remote Sensing Unit.
LAND USE INVESTIGATIONS IN THE CENTRAL VALLEY AND CENTRAL COASTAL TEST SITES, CALIFORNIA
John E. Estes *In* NASA. Goddard Space Flight Center Symp. on Signigicant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 907-914 ERTS (For availability see N73-28207 19-13)
(Paper-L4) CSCL 08B

The Geography Remote Sensing Unit (GRSU) at the University of California, Santa Barbara is responsible for investigations with ERTS-1 data in the Central Coastal Zone and West Side of the San Joaquin Valley. The nature of investigative effort involves the inventory, monitoring, and assessment of the natural and cultural resources of the two areas. Land use, agriculture, vegetation, landforms, geology, and hydrology are the principal subjects for attention. These parameters are the key indicators of the dynamically changing character of the areas. Monitoring of these parameters with ERTS-1 data will provide the techniques and methodologies required to generate the information needed by federal, state, county, and local agencies to assess change-related phenomena and plan for management and development. Author

N73-28301* California Univ., Riverside. Dept. of Geography.
LAND USE IN THE NORTHERN COACHELLA VALLEY
Jack B. Bale and Leonard W. Bowden *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 915-922 refs ERTS (For availability see N73-28207 19-13)
(Paper-L5) CSCL 08B

Satellite imagery has proved to have great utility for monitoring land use change and as a data source for regional planning. In California, open space desert resources are under severe pressure to serve as a source for recreational gratification to individuals living in the heavily populated southern coastal plain. Concern for these sensitive arid environments has been expressed by both federal and state agencies. The northern half of the Coachella Valley has historically served as a focal point for weekend recreational activity and second homes. Since demand in this area has remained high, land use change from rural to urban residential has been occurring continuously since 1968. This area of rapid change is an ideal site to illustrate the utility of satellite

imagery as a data source for planning information, and has served as the areal focus of this investigation. Author

N73-28302* Geological Survey, Washington, D.C.
LAND USE CLASSIFICATION AND CHANGE ANALYSIS USING ERTS-1 IMAGERY IN CARETS
Robert H. Alexander *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 923-930 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L6) CSCL 08B

Land use detail in the CARETS area obtainable from ERTS exceeds the expectations of the Interagency Steering Committee and the USGS proposed standardized classification, which presents Level 1 categories for ERTS and Level 2 for high altitude aircraft data. Some Levels 2 and 3, in addition to Level 1, categories were identified on ERTS data. Significant land use changes totaling 39.2 sq km in the Norfolk-Portsmouth SMSA were identified and mapped at Level 2 detail using a combination of procedures employing ERTS and high altitude aircraft data. Author

N73-28303* Geological Survey, Washington, D.C.
ERTS REGIONAL SCALE OVERVIEW LINKING LAND USE AND ENVIRONMENTAL PROCESSES IN CARETS
Robert H. Alexander *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 931-937 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L7) CSCL 08B

A mosaic of ERTS images of the CARETS region has been used to partition the region into zones on the basis of similarity of tones and textures visible at a regional-scale overview. The resulting patterns were compared with existing small scale maps of the region representing relief, land surface forms, geology, soils, vegetation, forest types, and land use. The ERTS-derived zones most closely resemble the patterns on the small scale land use map, suggesting that, at least in a highly developed region such as CARETS, land use is an indicator or resultant surface expression of several interacting environmental processes. These results lend support to the CARETS model of interdisciplinary regional analysis, whereby remote sensor-derived data sets on land use and land use change become the basic data entry into a regional information system to serve regional planners and land managers. Author

N73-28304* Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
EVALUATION OF LAND USE MAPPING FROM ERTS IN THE SHORE ZONE OF CARETS
Robert Dolan and Linwood Vincent *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L8) CSCL 08B

Imagery of the Atlantic shoreline zone of the Central Atlantic Regional Ecological Test Site (CARETS) was evaluated for classifying land use and land cover, employing the USGS Geographic Application Program's land use classification system. ERTS data can provide a basis for land cover and land use mapping within the shoreline zone, however because of the dynamic nature of this environment, two additional terms are considered: vulnerability of classes to storms and progressive erosion, and sensitivity of the classes to man's activities. Author

N73-28305* Polytechnical Univ. of Madrid (Spain).
INVESTIGATIONS USING DATA FROM EARTH RESOURCES TECHNOLOGY SATELLITE IN THE FIELDS OF AGRICULTURE/GEOGRAPHY. TIMBER INVENTORY (LAND USE) IN THE PROVINCE OF HUELVA, SPAIN
Emilio DeBenito, Serafin Lopez-Cuervo, and Joaquin Rodriguez *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 949-953 ERTS (For availability see N73-28207 19-13)
(Paper-L9) CSCL 08F

A test site was chosen for the purpose of elaborating the patterns for the future total use of the satellite photographs. The election of the test site was made with the following criteria in mind: (1) a flat terrain for eliminating the dangers of shadows produced by a difficult topography; and (2) searching of well defined natural limits for the test site. Due to the lack of satellite photographs from the study area, a number of photos from the northern area of Spain have been studied from the point of view of obtaining answers from the spectra of the vegetation masses. Author

N73-28306* Tennessee Univ., Knoxville. Dept. of Geography.
GEOGRAPHIC APPLICATIONS OF ERTS-1 DATA TO LANDSCAPE CHANGE
John B. Rehder *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 955-963 Original contains imagery. Original photography may be purchased from the EROS Data center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L10) CSCL 08F

The analysis of landscape change requires large area coverage on a periodic basis in order to analyze aggregate changes over an extended period of time. To date, only the ERTS program can provide this capability. Three avenues of experimentation and analysis are being used in the investigation: (1) a multi-scale sampling procedure utilizing aircraft imagery for ground truth and control; (2) a densitometric and computer analytical experiment for the analysis of gray tone signatures, comparisons and ultimately for landscape change detection and monitoring; and (3) an ERTS image enhancement procedure for the detection and analysis of photomorphic regions. Author

N73-28307* South Dakota State Univ., Brookings. Remote Sensing Inst.
IDENTIFICATION OF SOIL ASSOCIATIONS IN WESTERN SOUTH DAKOTA ON ERTS-1 IMAGERY
Frederick C. Westin and V. I. Myers *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 965-972 refs Submitted for publication ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21774)
(Paper-L11; SDSU-RSI-J-73-01) CSCL 08M

Soil association maps show the spatial relationships of land units having characteristic soil depths and textures, available water capacities, permeabilities, pH characteristics, plasticity indices, liquid limits, and the like, from which broad interpretations can be made such as how the soil is suited as a source for top soil, and as a source for sand and gravel, and how corrosive the soil is for steel and concrete, and what crop and grass yields can be expected. Film color composites of bands 4, 5 and 7 viewed over a light table with magnification show the soil associations of western South Dakota that are now recognized, and, in addition, several new soil association areas have been brought to light. Author

N73-28308* Dartmouth Coll., Hanover, N.H.
LAND USE OF NORTHERN MEGALOPOLIS
Robert B. Simpson and David T. Lindgren *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 973-980 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L12) CSCL 08B

The major objective is to map and digitize the land use of northern megalopolis, the states of Massachusetts, Connecticut, and Rhode Island, and to evaluate ERTS as a planning tool for megalopolitan areas. The southern New England region provides a good test ERTS's capabilities because of its complex landscape. Not only are there great differences in the degree of urban development, but in relief and vegetative cover as well. Author

N73-28309* Wyoming Univ., Laramie. Dept. of Geology.
REMOTE SENSING APPLIED TO LAND-USE STUDIES IN WYOMING
Roy M. Breckenridge, Ronald W. Marrs, and Donald J. Murphy *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 981-989 ERTS (For availability see N73-28207 19-13)
(Paper-L13) CSCL 08B

Impending development of Wyoming's vast fuel resources requires a quick and efficient method of land use inventory and evaluation. Preliminary evaluations of ERTS-1 imagery have shown that physiographic and land use inventory maps can be compiled by using a combination of visual and automated interpretation techniques. Test studies in the Powder River Basin showed that ERTS image interpretations can provide much of the needed physiographic and land use information. Water impoundments as small as one acre were detected and water bodies larger than five acres could be mapped and their acreage estimated. Flood plains and irrigated lands were successfully mapped, and some individual crops were identified and mapped. Coniferous and deciduous trees were mapped separately using color additive analysis on the ERTS multispectral imagery. Gross soil distinctions were made with the ERTS imagery, and were found to be closely related to the bedrock geology. Several broad unstable areas were identified. These were related to specific geologic and slope conditions and generally extended through large regions. Some new oil fields and all large open-cut coal mines were mapped. The most difficult task accomplished was that of mapping urban areas. Work in the urban areas provides a striking example of snow enhancement and the detail available from a snow enhanced image. Author

N73-28310* Minnesota Univ., Minneapolis. Dept. of Geography.
ERTS-1 APPLICATIONS TO MINNESOTA LAND USE MAPPING
Dwight Brown, James Gamble, Steven Prestin, Dale Trippler, Merle Meyer, Joseph Ulliman, and Ralph Eller *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 991-997 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L14) CSCL 08B

Land use class definitions that can be operationally employed with ERTS-1 imagery are being developed with the cooperation of personnel from several state, regional, and federal agencies with land management responsibilities within the state and the University of Minnesota. Investigations of urban, extractive, forest, and wetlands areas indicate that it is feasible to subdivide each of these classes into several sub-classes with the use of ERTS-1 images from one or more time periods. Author

N73-28311* Wisconsin Univ., Madison.
THE USE OF ERTS-1 DATA FOR THE INVENTORY OF CRITICAL LAND RESOURCES FOR REGIONAL LAND USE PLANNING
J. L. Clapp, R. W. Kiefer, M. M. McCarthy, and B. J. Niemann, Jr. *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1007-1014 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L16) CSCL 08B

Computer-generated spatial and statistical comparisons of critical land resource data derived from conventional sources, RB-57 photographs, and ERTS images, for an eastern Wisconsin test site, suggest that certain critical land resource data can be mapped from ERTS images on a statewide basis. This paper presents one of the biotic resources, wetlands, as an example of the use of ERTS imagery to inventory land resources. Author

N73-28312* Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INVESTIGATIONS OF AN URBAN AREA AND ITS LOCALE USING ERTS-1 DATA SUPPORTED BY U-PHOTOGRAPHY
H. A. Weeden, F. Y. Borden, D. N. Applegate, and N. Bolling *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1015-1022 refs Preared for Mitre Corp., Bedford, Mass. ERTS (For availability see N73-28207 19-13)
(Contracts NAS5-23133; MITRE-N-35490)
(Paper-L17) CSCL 08B

An urban area in central Pennsylvania and the surrounding locality were investigated separately at first by photointerpretation of ERTS-1 imagery and by computer processing of MSS tapes. Next the photointerpretation and processing were coordinated. The results of the cooperative effort of photointerpreters and computer processing analysts were much improved over independent efforts. It was found that single frames of U-2 photography could be projected onto printer output maps with little recognizable distortion in areas 10 to 25 cm square. In this way targets could be identified for use as training areas for computer processed signature identification. In addition, at any stage of category mapping, the level of success in correct classification could be assessed by this method. The results of the classification of the study area are discussed. Author

N73-28313* General Electric Co., Philadelphia, Pa. Space Div.
FIRST LOOK ANALYSES OF FIVE CYCLES OF ERTS-1 IMAGERY OVER COUNTY OF LOS ANGELES: ASSESSMENT OF DATA UTILITY FOR URBAN DEVELOPMENT AND REGIONAL PLANNING
S. Raje, R. Economy, and J. McKnight (Los Angeles County Regional Planning Comm.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1023-1030 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L18) CSCL 08B

Significant results have been obtained from the analyses of ERTS-1 imagery from five cycles over Test Site SR 124 by classical photointerpretation and by an interactive hybrid multispectral information extraction system (GEMS). The synopticity, periodicity and multispectrality of ERTS coverage, available for the first time to LA County planners, have opened up both a new dimensionality in data and offer new capability in preparation of planning inputs. Photointerpretation of ERTS images has produced over 25 overlays at 1:1,000,000 scale depicting regional relations and urban structure in terms of several hundred linear and areal features. To mention only one such result, a possible new fault lineament has been discovered on the northern slope of the Santa Monica mountains in the scene 1144-18015, composited of MSS bands 4, 5, 6. GEMS analysis of the ERTS products has provided new or improved information in the following planning data categories: urban vegetation; land cover segregation; man-made and natural impact monitoring; urban design; and suitability. ERTS data analysis has allowed planners to establish trends that directly impact planning policies. This new source of information will not only assist current methods to be more efficient, but permits entirely new planning methodologies to be employed. Author

N73-28314* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PREPARATION OF URBAN LAND USE INVENTORIES BY MACHINE PROCESSING OF ERTS MSS DATA
William Todd, Paul Mausel, and Kenneth Wenner *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1031-1039 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L19) CSCL 05B

Spectral classes of urban phenomena identified from Earth Resources Technology Satellite (ERTS) multispectral scanner data in Milwaukee included suburban inner city, industry, grassy (open area), road, wooded suburb, water cloud, and shadow. The Milwaukee spectral class statistics were used to classify the Chicago area, within the same ERTS frame, and similar results were achieved. In another ERTS frame, Marion County (Indianapolis) data were classified into similar classes. The Marion

County ERTS study was supported by a land use classification of an area near downtown Indianapolis that utilized 12-band MSS data collected by aircraft from 3000 feet. The results of the ERTS analyses suggest that satellite data will be a useful tool for the urban planner for monitoring urban land use.
Author

N73-28315* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A COMPARISON OF LAND-USE DETERMINATIONS USING DATA FROM ERTS-1 AND HIGH ALTITUDE AIRCRAFT
M. Ann Lundelius (Lockheed Electron. Co., Inc., Houston, Tex.), C. Mark Chestnutwood, Joe G. Garcia, and R. Bryan Erb *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1041-1046 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L20) CSCL 08B

A manual interpretation of ERTS-1 MSS system corrected imagery has been performed on a study area within the Houston Area Test Site to classify land use using the Level 1 categories proposed by the Department of the Interior. The two types of imagery used included: (1) black and white transparencies of each band enlarged to a scale of approximately 1:250,000 and (2) color transparencies composited from the computer compatible tapes using the film recorder on a multispectral data analysis station. The results of this interpretation have been compared with the 1970 land use inventory of HATS which was compiled using color ektachrome imagery from high altitude aircraft (scale 1:120,000). Urban data from the same scene was also analyzed using a computer-aided (clustering) technique. The resulting clusters, representing areas of similar content, were compared with existing land use patterns in Houston. A technique was developed to correlate the spectral clusters to specific urban features on aircraft imagery by the location of specific, high contrast objects in particular resolution elements. It was concluded that ERTS-1 data could be used to develop Level 1 and many Level 2 land use categories for regional inventories and perhaps to some degree on a local level.
Author

N73-28316* Environmental Research Inst. of Michigan, Ann Arbor.
DIGITAL LAND USE MAPPING IN OAKLAND COUNTY, MICHIGAN
Irvin J. Sattinger and Robert D. Dillman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1047-1054 Original contains imagery. Orginal photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L21) CSCL 08B

ERTS-1 data for a portion of Oakland County, Michigan was computer processed to produce a map of water, urban areas, wooded areas, and other vegetation. Comparison with RB-57 photography of the area shows a good correspondence of the two sources of data. Preliminary evaluation indicates that this type of four-category map derived from ERTS data will be useful for conceptual studies of large geographic areas in recreational planning.
Author

N73-28317* Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
MAPPING OF AGRICULTURAL LAND USE FROM ERTS-1 DIGITAL DATA
A. D. Wilson, G. A. Max, and G. W. Peterson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1055-1058 refs ERTS (For availability see N73-28207 19-13)
(Paper-L22) CSCL 08B

A study area was selected in Lancaster and Lebanon Counties, two of the major agricultural counties in Pennsylvania. This area was delineated on positive transparencies on MSS data collected on October 11, 1972 (1080-15185). Channel seven was used to delineate general land forms, drainage patterns, water and urban areas. Channel five was used to delineate highway networks. These identifiable features were useful aids for locating areas on the computer output. Computer generated maps were used to delineate broad land use categories, such as forest land, agricultural land, urban areas and water. These digital maps have a scale of approximately 1:24,000 thereby allowing direct comparison with U.S.G.S. 7.5 minute quadrangle sheets. Aircraft data were used as a form of ground truth useful for the delineation of land use patterns.
Author

N73-28318* Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
THE USE OF THE TEMPORAL DIMENSION IN CLASSIFYING AND MAPPING ERTS-1 MSS DATA
F. Y. Borden and D. N. Applegate *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1059-1066 ref ERTS (For availability see N73-28207 19-13)
(Paper-L23) CSCL 08B

Multispectral data from two ERTS-1 scenes of the same central Pennsylvania area were brought into registration by translation and then merged. The two scenes were viewed on different dates, but from adjacent ground tracks, as frequent cloud cover in Pennsylvania made it impossible to choose two scenes from the same track. Targets selected to be mapped included river water, railroad yards, creeks, urban areas, industrial areas, and vegetation. Equivalent training areas were chosen from each of the original scenes and from the merged data. Classification maps were produced for each, and a comparison was made. Scene brightness was found to have the most important effect on classification differences.
Author

N73-28319* Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
IDENTIFICATION AND MAPPING OF COAL REFUSE BANKS AND OTHER TARGETS IN THE ANTHRACITE REGION
F. Y. Borden, D. N. Thompson, and H. M. Lachowski *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1067-1074 refs ERTS (For availability see N73-28207 19-13)
(Paper-L24) CSCL 08G

ERTS-1 MSS data covering parts of Pennsylvania's southern and eastern middle anthracite coal fields were studied to determine how well accumulations of coal refuse could be identified and mapped by computer analysis and processing. Spectral signatures of coal refuse targets were similar to water, but had higher reflectances in all channels. Relative reflectances were in the order $4 > 5 >$ or $= 6 > 7$. Although no underflight photography was at hand to judge mapping success, correlation was made, with 1:24,000 scale U.S.G.S. maps dated 1947 and 1948. Coal refuse targets correlated well with existing maps.
Author

N73-28320* Honeywell, Inc., St. Paul, Minn. Systems and Research Div.
AUTOMATIC INTERPRETATION OF ERTS DATA FOR FOREST MANAGEMENT
Leonard Kirvida and Greg R. Johnson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1075-1082 Prepared in cooperation with Minn. Univ., St. Paul Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L25) CSCL 02F

Automatic stratification of forested land from ERTS-1 data provides a valuable tool for resource management. The results are useful for wood product yield estimates, recreation and wild life management, forest inventory and forest condition monitoring. Automatic procedures based on both multi-spectral and spatial features are evaluated. With five classes, training and testing on the same samples, classification accuracy of 74% was achieved using the MSS multispectral features. When adding texture computed from 8 x 8 arrays, classification accuracy of 99% was obtained.
Author

N73-28321* Environmental Research Inst. of Michigan, Ann Arbor.
LAND RESOURCES SURVEY FOR THE STATE OF MICHIGAN
Buzz Sellman *In* NASA. Goddard Space Flight Center Symp.

on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1083-1090 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L26) CSCL 08F

The usefulness of ERTS-1 satellite imagery as an information source for a statewide inventory of Michigan's land resources is documented. The project is currently relying on photointerpretation of MSS photography and computed processed results. The first task completed was a 1:500,000 scale land use map of the state in four classes: urban, forest, water, and agriculture and other. This map was constructed from existing (pre-ERTS-1) information sources including federal, state and county maps, and aerial photography. An ERTS color IR photomosaic for the entire state will also be constructed at a scale of 1:250,000. The Institute is currently working on tape processed data that will include both recognition data as well as a UTM coordinate addressing capability so that the final tape can be inputed directly into computerized land use and transportation corridor analysis models. Author

N73-28322* Environmental Research Inst. of Michigan, Ann Arbor.
TERRAIN CLASSIFICATION MAPS OF YELLOWSTONE NATIONAL PARK
Frederick J. Thomson and N. E. G. Roller *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1091-1095 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-L27) CSCL 08B

A cooperative ERTS-1 investigation involving U. S. Geological Survey, National Park Service, and Environmental Research Institute of Michigan (ERIM) personnel has as its goal the preparation of terrain classification maps for the entire Yellowstone National Park. Excellent coverage of the park was obtained on 6 August 1972 (frame 1015-17404). Preliminary terrain classification maps have been prepared at ERIM by applying multispectral pattern recognition techniques to ERTS-MSS digital taped data. The color coded terrain maps are presented and discussed. The discussion includes qualitative and quantitative accuracy estimates and discussion of processing techniques.
Author

N73-28323* Environmental Research Inst. of Michigan, Ann Arbor.
ATMOSPHERIC EFFECTS IN ERTS-1 DATA, AND ADVANCED INFORMATION EXTRACTION TECHNIQUES
William A. Malila and Richard F. Walepka *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1097-1104 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I1) CSCL 04B

Atmospheric effects in satellite multispectral scanner data can influence results obtained with either manual image interpretation or computer information extraction techniques. The atmosphere attenuates radiation arriving from the surface and adds an extraneous path radiance component. Initial results of an investigation of atmospheric effects in ERTS data are presented. Empirical analyses of ERTS MSS data and simultaneous airborne MSS underflight data for one frame, along with theoretical calculations of atmospheric effects, are discussed. The effect of limited spatial resolution on the accuracy of information extracted from ERTS data also is important. Problems occur when individual resolution elements contain two or more materials. Results from an initial application of ERIM techniques for estimating proportions of materials within individual elements are presented and discussed. Very accurate determination of surface areas of small lakes is achieved. Author

N73-28324* Science Applications, Inc., La Jolla, Calif.
DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE
Michael Griggs *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1105-1113 refs ERTS (For availability see N73-28207 19-13)
(Paper-I2) CSCL 04B

This investigation is designed to demonstrate the feasibility of determining the aerosol content in the atmosphere from contrast measurements of ground features, and from radiance measurements. Theoretical relationships between aerosol content and contrast reduction and radiance have been derived for ideal model atmospheres. The preliminary data analysis of the MSS transparencies has shown promising results for the contrast-aerosol content relationship in the Salton Sea/desert region.
Author

N73-28325* Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
A TECHNIQUE FOR THE CORRECTING ERTS DATA FOR SOLAR AND ATMOSPHERIC EFFECTS
Robert H. Rogers and Keith Peacock *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1115-1122 ERTS (For availability see N73-28207 19-13)
(Paper-I3) CSCL 05B

A technique is described by which an ERTS investigator can obtain absolute target reflectances by correcting spacecraft radiance measurements for variable target irradiance, atmospheric attenuation, and atmospheric backscatter. A simple measuring instrument and the necessary atmospheric measurements are discussed, and examples demonstrate the nature and magnitude of the atmospheric corrections. Author

N73-28326* International Imaging Systems, Mountain View, Calif.
EXPERIMENTAL MASKING OF RBV IMAGES TO REDUCE STATIONARY RESIDUAL INACCURACIES IN RADIOMETRIC CORRECTION
Donald S. Ross *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1123-1128 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I4) CSCL 05B

Return beam vidicon tube calibration data are used to correct spatially non-uniform radiance response in individual vidicons, during post-acquisition signal processing. However, examination of different ERTS-1 RBV-1, -2, and -3 image scenes showed stationary, repetitive residual inaccuracies in shading correction, large enough to affect qualitative and quantitative image analyses. Photographic masks designed to reduce residual shading were prepared from RBV-1, -2, and -3 images of a relatively cloud-free ocean scene of uniform reflectance. When applied to other RBV scenes, the masks enabled more closely corrected RBV images to be printed. Illustrations are given of RBV-1 image before and after correction, compared with an equivalent MSS spectral image of the same scene. Author

N73-28327* TRW Systems Group, Redondo Beach, Calif.
DIGITAL RECTIFICATION OF ERTS MULTISPECTRAL IMAGERY
Samuel S. Rifman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1131-1142 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I6) CSCL 05B

Rectified ERTS multispectral imagery have been produced utilizing all digital techniques, as the first step toward producing precision corrected imagery. Errors arising from attitude and ephemeris sources have been corrected, and the resultant image is represented in a meter/meter mapping utilizing an intensity resampling technique. Early results from available data indicate negligible degradation of the photometric and resolution properties of the source data as a consequence of the geometric correction process. Work utilizing ground control points to produce precision rectified imagery, and including photometric corrections resulting

from available sensor calibration data, is currently in progress.
Author

N73-28328* International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
RESULTS OF PRECISION PROCESSING (SCENE CORRECTION) OF ERTS-1 IMAGES USING DIGITAL IMAGE PROCESSING TECHNIQUES
Ralph Bernstein *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1143-1150 refs ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21716)
(Paper-I7) CSCL 05B

ERTS-1 MSS and RBV data recorded on computer compatible tapes have been analyzed and processed, and preliminary results have been obtained. No degradation of intensity (radiance) information occurred in implementing the geometric correction. The quality and resolution of the digitally processed images are very good, due primarily to the fact that the number of film generations and conversions is reduced to a minimum. Processing times of digitally processed images are about equivalent to the NDPF electro-optical processor. Author

N73-28329* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
SIGNIFICANT TECHNIQUES IN THE PROCESSING AND INTERPRETATION OF ERTS-1 DATA
S. B. Cousin, A. C. Anderson, J. F. Paris, and J. F. Potter *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1151-1158 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I8) CSCL 05B

The discipline oriented investigations underway at the Johnson Space Center (JSC) using ERTS-1 data provide an appropriate framework for the systematic evaluation of the various elements comprising a prototype multispectral data processing and analysis system. In particular such a system may be thought of as the integration of: (1) a preprocessing subsystem; (2) a spectral clustering subsystem, (3) a correlation and classification subsystem; (4) mensuration subsystem; and (5) an information management subsystem. Specific elements of this system are already operational at JSC. It is in the context of this system that technique development and application is being pursued at JSC. Aircraft, ERTS and EREP data will be utilized to refine the subsystem elements for each of the data acquisition systems or system combinations that are optimally suited for a specific Earth Resources application. The techniques reported are those that have been developed to date during the utilization of ERTS-1 data in this processing and analysis system. Author

N73-28330* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER TECHNIQUES USED FOR SOME ENHANCEMENTS OF ERTS IMAGES
Fred C. Billingsley and Alex F. H. Goetz *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1159-1167 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS7-100)
(Paper-I9) CSCL 05B

The JPL VICAR image processing system has been used for the enhancement of images received from the ERTS for the Arizona geology mapping experiment. This system contains flexible capabilities for reading and repairing MSS digital tape images, for geometric corrections and interpicture registration, for various enhancements and analyses of the data, and for display of the images in black and white and color. Author

N73-28331* California Univ., Davis. Dept. of Electrical Engineering.
DIGITAL ENHANCEMENT OF MULTISPECTRAL MSS DATA FOR MAXIMUM IMAGE VISIBILITY
Vidal Raphael Algazi *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1169-1177 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I10) CSCL 05B

A systematic approach to the enhancement of images has been developed. This approach exploits two principal features involved in the observation of images: the properties of human vision and the statistics of the images being observed. The rationale of the enhancement procedure is as follows: in the observation of some features of interest in an image, the range of objective luminance-chrominance values being displayed is generally limited and does not use the whole perceptual range of vision of the observer. The purpose of the enhancement technique is to expand and distort in a systematic way the grey scale values of each of the multispectral bands making up a color composite, to enhance the average visibility of the features being observed. Author

N73-28332* California Univ., Riverside. Dept. of Geography.
ERTS-1 IMAGE ENHANCEMENT BY OPTICALLY COMBINING DENSITY SLICES
Gerald O. Tapper and Robert W. Pease *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1179-1185 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I11) CSCL 05B

The technique of density slicing using a photographic film and its application to enhancement of ERTS-1 imagery has proved to be useful for mapping varigated areal phenomena and provides a useful supplement ot the I2S MiniAddcol viewing system. The intial experiments conducted with this film were encouraging, and indicated that this technique of density slicing using readily accessible darkroom facilities and simple darkroom procedures allows rapid, accurate, and facile interpretation of certain areal phenomena to be made from the imagery. The distribution of the tree yucca, Yucca brevifolia Jaegeriana, in the eastern Mojave Desert of Southern California and southern Nevada was used as an example to test the accuracy of the technique for mapping purposes. The distribution was mapped at a relatively high level of accuracy. Author

N73-28333* RAND Corp., Santa Monica, Calif.
PSEUDOCOLOR TRANSFORMATION OF ERTS IMAGERY
Jeannine Lamar and Paul M. Merifield (Earth Sci. Res. Corp.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1187-1198 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I12) CSCL 05B

One of the photographic techniques which shows great promise as an aid in interpreting ERTS imagery is pseudocolor transformation. It is a process where each shade of gray in an original black-and-white image is seen as a different color in the transformation. The well known ERTS-1 MSS image of the Monterey Bay-San Francisco area was transformed using a technique which requires only two intermediate separations. Possible faults were delineated on an overlay of the transformation before referring to geologic maps. The results were quite remarkable in that all large active or recently active faults shown on the latest geologic map of California were interpreted from the image for all, or much, of their length. Perhaps the most interesting result was the Reliz fault. The fault is shown as covered; however, a lineation corresponding to the position of the fault is visible on the image. The usefulness of ERTS image in identifying recently active faults is demonstrable. Although the faults are also visible in the unenhanced image, they are clearly accentuated and more easily mapped on the pseudocolor transformation. Author

N73-28334* Tetra Tech, Inc., Houston, Tex.
DIGITAL INTERACTIVE IMAGE ANALYSIS BY ARRAY PROCESSING
Bruno E. Sabels and Jerry D. Jennings (Geocom, Inc.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1199-1203 ERTS (For availability see N73-28207 19-13)
(Paper-I13) CSCL 05B

An attempt is made to draw a parallel between the existing geophysical data processing service industries and the emerging earth resources data support requirements. The relationship of seismic data analysis to ERTS data analysis is natural because in either case data is digitally recorded in the same format, resulting from remotely sensed energy which has been reflected, attenuated, shifted and degraded on its path from the source to the receiver. In the seismic case the energy is acoustic, ranging in frequencies from 10 to 75 cps, for which the lithosphere appears semi-transparent. In earth survey remote sensing through the atmosphere, visible and infrared frequency bands are being used. Yet the hardware and software required to process the magnetically recorded data from the two realms of inquiry are identical and similar, respectively. The resulting data products are similar. Author

N73-28335* California Univ., Berkeley. Forestry Remote Sensing Lab.
COMBINING HUMAN AND COMPUTER INTERPRETATION CAPABILITIES TO ANALYZE ERTS IMAGERY
J. D. Nichols *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1205-1210 ERTS (For availability see N73-28207 19-13)
(Paper-I14) CSCL 05B

The human photointerpreter and the computer have complementary capabilities that are exploited in a computer-based data analysis system developed at the Forestry Remote Sensing Laboratory, University of California. This system is designed to optimize the process of extracting resource information from ERTS images. The human has the ability to quickly delineate gross differences in land classes, such as wildland, urban, and agriculture on appropriate ERTS images, and to further break these gross classes into meaningful subclasses. The computer, however, can more efficiently analyze point-by-point spectral information and localized textural information which can result in a much more detailed agricultural or wildland classification based on species composition and/or plant association. These human and computer capabilities have been integrated through the use of an inexpensive small scale computer dedicated to the interactive preprocessing of the human inputs and the display of raw ERTS images and computer classified images. The small computer is linked to a large scale computer system wherein the bulk of the statistical work and the automatic point-by-point classification is done. Author

N73-28336* Stanford Research Inst., Menlo Park, Calif.
ANALYSIS OF ERTS IMAGERY USING SPECIAL ELECTRONIC VIEWING/MEASURING EQUIPMENT
William E. Evans and Sidney M. Serebreny *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1211-1218 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contract NAS5-21841)
(Paper-I15) CSCL 05B

An electronic satellite image analysis console (ESIAC) is being employed to process imagery for use by USGS investigators in several different disciplines studying dynamic hydrologic conditions. The ESIAC provides facilities for storing registered image sequences in a magnetic video disc memory for subsequent recall, enhancement, and animated display in monochrome or color. Quantitative measurements of distances, areas, and brightness profiles can be extracted digitally under operator supervision. Initial results are presented for the display and measurement of snowfield extent, glacier development, sediment plumes from estuary discharge, playa inventory, phreatophyte and other vegetative changes. Author

N73-28337* Kansas Univ. Center for Research, Inc., Lawrence. Space Technology Labs.
COMBINED SPECTRAL AND SPATIAL PROCESSING OF ERTS IMAGERY DATA
Robert M. Haralick and K. Sam Shanmugam *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1219-1228 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I16) CSCL 05B

A procedure for extracting a set of textural features for ERTS-1 MSS data is presented. The textural features were combined with a set of spectral features and were used to develop a classification algorithm for identifying the land use categories of blocks of digital MSS data. The classification algorithm was derived from a training set of 314 blocks and tested on a set of 310 blocks. The overall accuracy of the classifier was found to be 83.5% on seven land use categories. Author

N73-28338* Itek Corp., Lexington, Mass. Optical Systems Div.
TERRAIN TYPE RECOGNITION USING ERTS-1 MSS IMAGES
Nicholas Gramenopoulos *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1229-1241 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I17) CSCL 08B

For the automatic recognition of earth resources from ERTS-1 digital tapes, both multispectral and spatial pattern recognition techniques are important. Recognition of terrain types is based on spatial signatures that become evident by processing small portions of an image through selected algorithms. An investigation of spatial signatures that are applicable to ERTS-1 MSS images is described. Artifacts in the spatial signatures seem to be related to the multispectral scanner. A method for suppressing such artifacts is presented. Finally, results of terrain type recognition for one ERTS-1 image are presented. Author

N73-28339* Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
CLASSIFICATION OF ERTS-1 MSS DATA BY CANONICAL ANALYSIS
H. M. Lachowski and F. Y. Borden *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1243-1251 refs ERTS (For availability see N73-28207 19-13)
(Paper-I18) CSCL 05B

The objective of canonical analysis is to obtain the maximum separability among a number of catergories. The application of canonical analysis was investigated using the merged MSS ERTS-1 data for one area viewed on two dates. The effect of threshold values on classification regions and confusion regions was investigated. Author

N73-28340* Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA
Edward F. Yost *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1253-1258 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-I19) CSCL 05B

The task of correlating in situ spectral reflectance measurements with ERTS imagery has commenced. A method of additive color analysis of a single multispectral band taken on different dates indicates that ERTS-1 bulk images have sufficient spatial and spectral fidelity to show indications of the presence of soil moisture in desert playas and changes in soil moisture with time. The chain of causality between soil moisture, in situ

spectral reflectance, and ERTS multispectral scanner image density remains to be established during the subsequent phases of this study. Author

N73-28341* Maryland Geological Survey, Baltimore.
SEASONAL CHANGES OF LITTORAL TRANSPORT AND BEACH WIDTH AND RESULTING EFFECT ON PROTECTIVE STRUCTURES
Turbit H. Slaughter *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1259-1267 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M1) CSCL 08C

The shorelines of Maryland's portion of the Chesapeake Bay exhibit seasonal changes in direction of littoral transport and resulting beach width. Observation and study of this process at selected locations emphasizes the necessity of study for a complete year's seasonal cycle before stating erosion rates of an area to be protected by structures and the cyclincal presence or absence of beaches. Seasonal beach conditions at four selected sites are described along with resulting physical changes to protective structures. Through the use of ERTS-1 multi-spectral photography, it will be possible to make widespread predictions elsewhere in the Bay as a direct aid in protective structure design. Author

N73-28342* Maryland Geological Survey, Baltimore.
RECOGNITION OF BEACH AND NEARSHORE DEPOSITIONAL FEATURES OF CHESAPEAKE BAY
Randall T. Kerhin *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1269-1274 refs ERTS (For availability see N73-28207 19-13)
(Paper-M2) CSCL 08C

Beach and nearshore depositional features are being mapped with the objectives of determining a quick-look analysis of littoral drift and sedimentation patterns in areas of little or no data. Evaluation of beach and nearshore features aid in the selection of small boat harbors, shoreline protective structures, and general coastal zone development. Through ERTS-1 aircraft support imagery, beach depositional features mapped are cuspate forelands, welded beach ridges, and recurved spits. The nearshore depositional features exhibit a bar and trough topography with three distinct types of sedimentary structures; longshore, transverse, and reticulated bars. Synoptic coverage of beach and nearshore depositional features by ERTS-1 data help in determining the general sedimentation patterns, growth of the beach features and stability of the bar and trough topography. Author

N73-28343* Delaware Univ., Newark. Coll. of Marine Studies.
APPLICABILITY OF ERTS-1 IMAGERY TO THE STUDY OF SUSPENDED SEDIMENT AND AQUATIC FRONTS
V. Klemas, R. Srna, W. Treasure, and M. Otley *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1275-1290 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Contracts NAS5-21837; N00014-69-A-0407)
(Paper-M3) CSCL 08J

Imagery from three successful ERTS-1 passes over the Delaware Bay and Atlantic Coastal Region have been evaluated to determine visibility of aquatic features. Data gathered from ground truth teams before and during the overflights, in conjunction with aerial photographs taken at various altitudes, were used to interpret the imagery. The overpasses took place on August 16, October 10, 1972, and January 26, 1973, with cloud cover ranging from about zero to twenty percent. (I.D. Nos. 1024-15073, 1079-15133, and 1187-15140). Visual inspection, density slicing and multispectral analysis of the imagery revealed strong suspended sediment patterns and several distinct types of aquatic interfaces or frontal systems. Author

N73-28344* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CORRELATION OF ERTS MULTISPECTRAL IMAGERY WITH SUSPENDED MATTER AND CHLOROPHYLL IN LOWER CHESAPEAKE BAY
D. E. Bowker, P. Fleischer (Old Dominion Univ.), T. A. Gosink (Old Dominion Univ.), W. J. Hanna (Old Dominion Univ.), and J. Ludwick (Old Dominion Univ.) *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1291-1297 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Aveune, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M4) CSCL 08J

The feasibility of using multispectral satellite imagery to monitor the characteristics of estuarine waters is being investigated. Preliminary comparisons of MSS imagery with suspended matter concentrations, particle counts, chlorophyll, transmittance and bathymetry have been made. Some visual correlation of radiance with particulates and chlorophyll has been established. Effects of bathymetry are present, and their relation to transmittance and radiance is being investigated. Greatest detail in suspended matter is revealed by MSS band 5. Near-surface suspended sediment load and chlorophyll can be observed in bands 6 and 7. Images received to date have partially defined extent and location of high suspensate concentrations. Net quantity of suspended matter in the lower Bay has been decreasing since the inception of the study, and represents the diminution of turbid flood waters carried into the Bay in late September, 1972. The results so far point to the utility of MSS imagery in monitoring estuarine water character for the assessment of siltation, productivity, and water types. Author

N73-28345* Geological Survey, Hartford, Conn.
PLUME DEVELOPMENT IN LONG ISLAND SOUND OBSERVED BY REMOTE SENSING (ERTS-1)
Frederick H. Ruggles, Jr. *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1299-1303 ref ERTS (For availability see N73-28207 19-13)
(Paper-M5) CSCL 08J

As the Connecticut River flows into Long Island Sound, large plumes are developed during the mixing of ocean and estuarine waters. Plumes were delineated for July 28, October 8, October 27, and December 2, 1972, by analyzing ERTS-1 imagery with the SRI electronic satellite image analysis console (ESIAC). Insertion of MSS band 5 into the ESIAC produced the best result in this analysis. The four plumes that have been delineated provide the first input to a time-lapse analysis of circulation patterns at the eastern end of Long Island Sound. Author

N73-28346* Geological Survey, Menlo Park, Calif. Office of Marine Geology.
NEW INSIGHTS INTO THE INFLUENCE OF ICE ON THE COASTAL MARINE ENVIRONMENT OF THE BEAUFORT SEA, ALASKA
Peter W. Barnes and Erk Reimnitz *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1307-1314 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M7) CSCL 08L

Areal patterns from field data and ERTS-1 imagery have shown a close relationship between geologic processes and the influence of sea ice along Alaska's northern coast, perhaps the nation's least known continental margin. Ice acts as; (1) a bottom-gouging agent; (2) an influence on water circulation; (3) a carrier of sediments; and (4) an influence on water types. Author

N73-28347* Alaska Univ., Fairbanks. Inst. of Marine Science.
ERTS-1 OBSERVATIONS OF SEA SURFACE CIRCULATION AND SEDIMENT TRANSPORT, COOK INLET, ALASKA
F. F. Wright, G. D. Sharma, and D. C. Burbank *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1315-1322 refs Original contains imagery. Original photography may be purchased from the EROS Data Center,

10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M8) CSCL 08J

Cook Inlet is a large tide-dominated estuary in southern Alaska. Highly turbid streams enter the upper inlet, providing an excellent tracer for circulation in the lower inlet. MSS 4 and 5 images both can be used in this area to plot sediment and pollutant trajectories, areas of (probable) commercial fish concentration, and the entire circulation regime. Author

N73-28348* Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SEDIMENT DISTRIBUTION AND COASTAL PROCESSES IN COOK INLET, ALASKA
Duwayne M. Anderson, Lawrence W. Gatto, Harlan L. McKim, and Anthony Petrone *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1323-1339 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M9) CSCL 08J

Regional hydrologic and oceanographic relationships in Cook Inlet, Alaska have been recognized from sequential ERTS-1 MSS imagery. Current patterns are visible in the inlet because of differential concentrations of suspended sediment. The circulation patterns within Cook Inlet are controlled primarily by the interaction between the semi-diurnal tides and the counter clockwise Alaska current. In general, heavily sediment laden water is seen to be confined to portions of the inlet north of the Forelands and west of Kalgin Island. Tongues of clear oceanic water are observed to enter the inlet through Kennedy Channel along the east shoreline in the vicinity of Cape Elizabeth. A recurring counterclockwise circulation pattern observed around Kalgin Island seems to result from the interplay of the northerly moving water along the east shore and the southerly moving, sediment laden, water along the west side of the inlet. Prominent, fresh water plumes, heavily laden with sediment are visible at the mouths of all major rivers. Relect plumes from as many as three tidal stages have been recognized. Author

N73-28349* Geological Survey, Corpus Christi, Tex.
DISTRIBUTION AND MOVEMENT OF SUSPENDED SEDIMENT IN THE GULF OF MEXICO OFF THE TEXAS COAST
Ralph E. Hunter *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1341-348 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M10) CSCL 08J

ERTS-1 imagery has proven very useful in studies of the distribution of suspended sediment in the Gulf of Mexico off the Texas coast. Moreover, by using suspended matter concentrations as tags on water masses, much information on water movement can be obtained. The utility of suspended sediment as a tracer is dependent on the sediment remaining in suspension long enough to travel an appreciable distance or to be visible on successive images. Although the evidence is not conclusive, it seems likely that much of the suspended sediment in Gulf of Mexico nearshore waters during normal seastate conditions has remained in suspension since the time of its entry into the Gulf of Mexico through rivers and tidal inlets. Author

N73-28350* Arizona Univ., Tucson.
OCEANOGRAPHIC MAPPING OF STRUCTURE AND DYNAMICS OF THE NORTHERN GULF OF CALIFORNIA BY THE USE OF SPECTRAL MODELING AND ERTS-1
L. K. Lepley, Gustavo Calderon, and J. R. Hendrickson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1349-1356 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M11) CSCL 08J

Distribution and flow of water masses at four depth intervals were determined by analyzing ERTS imagery through the use of optical models of classes of vertical oceanographic profiles. Data used for these models was obtained from shipboard measurements including surface spectral radiance, and optical and more conventional oceanographic depth profiles. The spectral models obtained were applied to radiance-contoured ERTS imagery in band 4, 5, 6, and 7. Features mapped by direct photointerpretation of ERTS imagery include submerged shoals, current streamlines, and location of possible upwellings, downwellings and submarine springs. Author

N73-28351* National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
OCEANOGRAPHIC FEATURES IN THE LEE OF THE WINDWARD AND LEEWARD ISLANDS: ERTS AND SHIP DATA
Kirby J. Hanson, Frank Hebard, and Richard Cram (Miami Univ., Coral Gables, Fla.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1357-1363 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M12) CSCL 08J

Analysis of the ERTS data in portions of the eastern Caribbean are presented for October 1972 showing features which are, as yet, not explained. Ground truth data obtained in that area during November 1972 are presented. These include vertical temperature structure in the mixed layer and thermocline, and surface measurements of salinity, temperature, and chlorophyll. Author

N73-28352* National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
REMOTE SENSING OF OCEAN CURRENTS USING ERTS IMAGERY
George A. Maul *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1365-1375 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-M13) CSCL 08C

Major ocean currents such as the Loop Current in the eastern Gulf of Mexico have surface manifestations which can be exploited for remote sensing. Surface chlorophyll-a concentrations, which contribute to the shift in color from blue to green in the open sea, were found to have high spatial variability; significantly lower concentrations were observed in the current. The cyclonic edge of the current is an accumulation zone which causes a peak in chlorophyll concentration. The dynamics also cause surface concentrations of algae, which have a high reflectance in the near infrared. Combining these observations gives rise to an edge effect which can show up as a bright lineation on multispectral imagery delimiting the current's boundary under certain environmental conditions. When high seas introduce bubbles, white caps, and foam, the reflectance is dominated by scattering rather than absorption. This has been detected in ERTS imagery and used for current location. Author

N73-28353* Environmental Research and Technology, Inc., Lexington, Mass.
USE OF ERTS DATA FOR MAPPING ARCTIC SEA ICE
James C. Barnes and Clinton J. Bowley *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1 Vol. 1, Sect. A and B 1973 p 1377-1384 refs ERTS (For availability see N73-28207 19-13)
(Paper-M14) CSCL 08L

This investigation is to evaluate the application of ERTS data for detecting and mapping Arctic sea ice. The specific objectives are to determine the spectral bands most suitable for detecting ice, to measure the scale and types of ice features that can be detected, and to develop interpretive techniques for differentiating ice from clouds and for mapping ice concentrations. The ERTS data are being analyzed primarily for three Arctic areas, the eastern Beaufort Sea, Baffin Bay, and the Greenland Sea. Author

N73-28354* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

BIOMASS IN THE UPWELLING AREAS ALONG THE NORTHWEST COAST OF AFRICA AS VIEWED WITH ERTS-1

Karl-Heinz Szekielda (Delaware Univ.) and Robert J. Curran *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1385-1401 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

(Paper-M15) CSCL 08A

Light penetration in water is affected by plankton, algae, and dissolved and suspended matter. As a consequence, the composition of backscattered light from below the air-sea interface is determined by the nature of the constituents in the water column. In contrast to the absorption spectrum of chemically pure chlorophyll in solution, algae suspensions absorb and scatter light more uniformly throughout the visible part of the electromagnetic spectrum. Because of their spectral absorption and scattering properties plankton concentration can be estimated by measuring the spectral backscattered radiance over water. Experiments using this approach were performed in upwelling regions along the northwest coast of Africa. Author

N73-28355* Earth Satellite Corp., Washington, D.C.

APPLICATION OF ERTS-1 IMAGERY TO THE HARVEST MODEL OF THE US MENHADEN FISHERY

Paul M. Maughan, Allan D. Marmelstein, and O. Ray Temple *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1405-1411 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

(Paper-M17) CSCL 08A

Preliminary results of an experiment to demonstrate the utility of ERTS-1 imagery for providing significant information to the harvest model of the menhaden industry are reported. Fisheries and related environmental data were obtained discontinuously throughout the 1973 menhaden (a surface schooling, coastal species) fishing season in Mississippi Sound. The unexpected complexity of the physical environment in Mississippi Sound precluded simplistic analysis of fish/environment relationships. Preliminary indications are that an association does exist between fish availability and differences in water transparency (turbidity) within the Sound. A clearer relationship is developing between major turbid features, imaged by ERTS-1 and location of successful fishing attempts. On all occasions where relatively cloudfree ERTS-1 overflight days coincided with fishery activity, overlays of catch location of ERTS-1 images show an association of school position with interfaces between imaged turbid features. Analysis is currently underway to determine persistence of such associations in an attempt to define minimum satellite return time necessary to maintain continuity of associations. Author

N73-28356* Geological Survey, Washington, D.C.

COASTAL AND SUBMARINE FEATURES ON MSS IMAGERY OF SOUTHEASTERN MASSACHUSETTS: COMPARISON WITH CONVENTIONAL MAPS

Richard S. Williams, Jr. *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1413-1422 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

(Paper-M18) CSCL 08B

Three ERTS-1, MSS images of southeastern Massachusetts, including Cape Cod Bay, Cape Cod, and Nantucket Sound, show a variety of dynamic geologic and hydrologic phenomena. Coastal features imaged include the coastline at different time in the tidal cycle, harbors, lakes and ponds, marshes (wetlands), and beach and dune areas; submarine features include tidal flats, shoals, dredged and natural channels, and bars. Comparison with conventional maps at 1:1,000,000 and 1:250,000 scales show many inaccuracies between the ERTS imagery and the two map scales. The ERTS-1 imagery can be used to increase the accuracy of these maps, portray additional environmental information, and provide the capability for frequent updating of maps at such scales. ERTS-1 imagery provides a very cost effective method for provision of certain types of environmental data for Cape Cod and environs. Author

N73-28357* International Imaging Systems, Mountain View, Calif.

WATER DEPTH ESTIMATION WITH ERTS-1 IMAGERY

D. S. Ross *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1423-1432 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

(Paper-M19) CSCL 08J

Contrast-enhanced 9.5 inch ERTS-1 images were produced for an investigation on ocean water color. Such images lend themselves to water depth estimation by photographic and electronic density contouring. MSS-4 and -5 images of the Great Bahama Bank were density sliced by both methods. Correlation was found between the MSS-4 image and a hydrographic chart at 1:467,000 scale, in a number of areas corresponding to water depth of less than 2 meters, 5 to 10 meters and 10 to about 20 meters. The MSS-5 image was restricted to depths of about 2 meters. Where reflective bottom and clear water are found, ERTS-1 MSS-4 images can be used with density contouring by electronic or photographic methods for estimating depths to 5 meters within about one meter. Author

N73-28358* Environmental Research Inst. of Michigan, Ann Arbor.

CALCULATIONS OF WATER DEPTH FROM ERTS-MSS DATA

Fabian C. Polcyn and David R. Lyzenga *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1433-1441 refs Original Contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

(Paper-M20) CSCL 08J

ERTS-1 MSS data taken on October 10, 1972 of the Little Bahama Bank are being used to demonstrate the use of ERTS-1 data for mapping of shallow water features for the purpose of upgrading world navigation charts. Marked reflectance differences occur for the shallow water areas in Bands 4, 5, and 6. Digital processing of two adjacent data tapes within the ERTS frame covering an area of about 40 by 40 miles has been completed. Correlation of depth measurements to 5 meters has been successful. A mathematical model for depth measurements using ratio of voltages in Band 4 and 5 has been successfully developed and is being tested for accuracy. Additional studies for areas near Puerto Rico and in Northern Lake Michigan will be undertaken. Satellite data will also provide geographical evidence for verifying existence or nonexistence of doubtful shoal waters now appearing on world charts and considered to be hazardous to shipping. Author

N73-28359* North Carolina State Univ., Raleigh.

MULTIDISCIPLINARY APPLICATION OF ERTS-1 DATA TO NORTH CAROLINA NATURAL RESOURCES MANAGEMENT

Charles W. Welby, J. O. Lammi, and Robert J. Carson *In* NASA. Goddard Space FLight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1443-1450 Original contains imagery. Original photography may be purvhased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

(Paper-R1) CSCL 08F

Two examples are given of ERTS-1 data: monitoring of man's activities affecting forest resources and pinpointing sources of sediment load in streams and rivers in North Carolina. Author

N73-28360* Oregon State Univ., Corvallis.

NATURAL RESOURCES INVENTORY AND MONITORING IN OREGON WITH ERTS IMAGERY

G. H. Simonson, D. P. Paine, C. E. Poulton, R. D. Lawrence, J.

H. Sherzog, and R. J. Murray *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1451-1458 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-R2) CSCL 08F

Multidiscipline team interpretation of ERTS satellite and highflight imagery is providing resource and land use information needed for land use planning in Oregon. A coordinated inventory of geology, soil-landscapes, forest and range vegetation, and land use for Crook County, illustrates the value of this approach for broad area and state planning. Other applications include mapping fault zones, inventory of forest clearcut areas, location of forest insect damage, and monitoring irrigation development. Computer classification is being developed for use in conjunction with visual interpretation. Author

N73-28361* Ohio Dept. of Economic and Community Development, Columbus.
RESOURCE MANAGEMENT IMPLICATIONS OF ERTS-1 DATA TO OHIO
David C. Sweet, Terry L. Wells, and George E. Wukelic (Battelle Columbus Labs., Ohio) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1459-1466 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-R3) CSCL 08F

Initial experimental analysis of ERTS-1 imagery has demonstrated that remote sensing from space is a means of delineating and inventorying Ohio's strip-mined areas, detecting power plant smoke plumes, and proving the data necessary for periodically compiling land use maps for the entire state. The nature and extent of these problems throughout Ohio, how ERTS data can contribute to their solution, and estimates of the long term spgnificance of these initial findings to overall resource management interests in Ohio are summarized. Author

N73-28362* California Univ., Riverside. Dept. of Geography.
ASSESSMENT OF SOUTHERN CALIFORNIA ENVIRONMENT FROM ERTS-1
Lzonard W. Bowden and James H. Viellenave *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1467-1474 ERTS (For availability see N73-28207 19-13)
(Paper-R4) CSCL 08F

ERTS-1 imagery is a useful source of data for evaluation of earth resources in Southern California. The improving quality of ERTS-1 imagery, and our increasing ability to enhance the imagery has resulted in studies of a variety of phenomena in several Southern California environments. These investigations have produced several significant results of varying detail. They include the detection and identification of macro-scale tectonic and vegetational patterns, as well as detailed analysis of urban and agricultural processes. The sequential nature of ERTS-1 imagery has allowed these studies to monitor significant changes in the environment. In addition, some preliminary work has begun directed toward assessing the impact of expanding recreation, agriculture and urbanization into the fragile desert environment. Refinement of enhancement and mapping techniques and more intensive analysis of ERTS-1 imagery should lead to a greater capability to extract detailed information for more precise evaluations and more accurate monitoring of earth resources in Southern California. Author

N73-28363* American Univ., Washington, D.C. Dept. of Biology.
APPLICATIONS OF REMOTE SENSING (ERTS) TO RESOURCE MANAGEMENT AND DEVELOPMENT IN SAHELIEN AFRICA (REPUBLIC OF MALI)
N. H. MacLeod *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1475-1481 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-R5) CSCL 08F

The primary resourcemanagement problem is Sub-Saharan Africa (the Sahel) is increasing aridity or desertification. Space observations of sand streams, dune orientations, moisture and vegetation changes and other factors associated with desertification have been made. A second majorinterest is grazing of cattle, sheep and goats which is associated with major movements of people and animals twice yearly to obtain forage. The changes in available forage are being observed. The location of the cultivators is also being mapped from ERTS imagery. Hydrological analysis is being carried on in the Niger and Bani river watersheds. So far, good imagery of the maximum flood stage has been obtained and assessed. Author

N73-28364* Institut Francais du Petrole, Rueil-Malmaison.
FIRST ERTS-1 RESULTS IN SOUTHEASTERN FRANCE: GEOLOGY, SEDIMENTOLOGY, POLLUTION AT SEA
A. Fontanel, J. Guillemot, and M. Guy *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1483-1511 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
(Paper-R6) CSCL 08C

Results obtained by four ERTS projects in southeastern France are summarized. With regard to geology, ERTS photos of Western Alps are very useful for tectonic interpretation because large features are clearly visible on these photographs even though they are often hidden by small complicated structures if studied on large scale documents. The 18-day repetition coverage was not obtained, and time-varying sedimentological surveys were impossible. Nevertheless, it was possible to delineate the variations of the shorelines in the Rhone Delta for a period covering the least 8,000 years. Some instances of industries discharging pollutant products at sea were detected, as well as very large anomalies of unknown origin. Some examples of coherent optical processing have been made in order to bring out tectonic features in the Alps mountains. Author

N73-28365* Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.
DCP-COLLECTED ABSOLUTE TARGET REFLECTANCE SIGNATURES ASSIST ACCURATE INTERPRETATION OF ERTS-1 IMAGERY
Frederick P. Weber *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1513-1522 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 05B

Data collection platforms (DCP's) are being used at a Black Hills, South Dakota, test site (MMC 226A) to record radiometric measurements needed to determine solar and atmospheric parameters that affect ERTS-1 multispectral scanner radiance measurements. A total of 72 channels of analog data transmitted from an unattended ground truth site via three DCP's at least six times a day. The system has operated with only minor problems since September, sending forth daily measurements of biophysical responses and atmospheric conditions. Comparisons of scene radiance data calculated from ERTS images with that measured on the ground show the image-measured values to be 35 percent higher for the green channel and 20 percent higher for the red channel for the same scene targets. Radiance values for channels 6 and 7 are nearly the same from the ground data and from the imagery. Author

N73-28366* Geological Survey, Washington, D.C.
UNIQUE CHARACTERISTICS OF ERTS
Alden P. Colvocoresses *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1523-1525 ERTS (For availability see N73-28207 19-13)
CSCL 05B

The manned spaceflights have demonstrated what film cameras can do in space and they could provide a data source from which maps would be one of the principal products. ERTS

was not defined with mapping as one of its principal objectives, but with ERTS-1 in orbit certain unique characteristics or advantages of the electronic transmission (TV) earth sensing system become apparent to the mapmaker. Six of the more obvious advantages over aircraft and satellite film systems are: (1) long life and coverage; (2) near real time; (3) orthogonality; (4) radiometric fidelity; (5) extension into the near IR wavelengths; and (6) extension into the thermal wavelengths. Author

N73-28367* Paterson State Coll., N.J. Dept. of Geography.
ERTS-1 APPLIED FOR STRUCTURAL AND MORPHOLOGICAL INVESTIGATIONS CASE STUDIES. 1: LOS ANGELES, CALIFORNIA. 2: COASTAL PLAIN, NEW JERSEY
Ervin Y. Kedar *In* NASA. Goddard Space Flight Center Symp. on Significant Results Obtained from the ERTS-1, Vol. 1, Sect. A and B. 1973 p 1527-1538 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08E

Two major earth's resources management problems, the application of ERTS-1 imagery for geomorphotectonics, and subsequently seismic-risk, earthquake, and mineral exploration applications are discussed. Case studies are presented for Los Angeles, California, and New Jersey coastal plain. Author

N73-28368* Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. per la Geofisica della Litosfera.
A PRELIMINARY EVALUATION OF ERTS-1 IMAGES ON THE VOLCANIC AREAS OF SOUTHERN ITALY
R. Cassinis and G. M. Lechi *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1539-1548 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08E

The test site selected for the investigation covers nearly all the regions of active and quiescent volcanism in southern Italy, i.e. the eastern part of the island of Sicily, the Aeolian Islands and the area of Naples. The three active European volcanoes (Etna, Stromboli and Vesuvius) are included. The investigation is in the frame of a program for the surveillance of active volcanoes by geophysical (including remote sensing thermal methods) and geochemical methods. By the multispectral analysis of ERTS-1 data it is intended to study the spectral behavior of the volcanic materials as well as the major geological lineaments with special reference to those associated with the volcanic region. Secondary objectives are also the determination of the hydrographic network seasonal behavior and the relationship between the vegetation cover and the different type of soils and rocks. Author

N73-28369* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL SURVEILLANCE OF CASCADE RANGE VOLCANOES USING ERTS-1 MULTISPECTRAL SCANNER, AIRCRAFT IMAGING SYSTEMS, AND GROUND-BASED DATA COMMUNICATION PLATFORMS
Jules D. Friedman (Geol. Survey, Washington D. C.), David G. Frank (Geol. Survey, Tacoma, Wash.), Duane Preble (Geol. Survey, Bay St. Louis, Mo.), and J. Earle Painter *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1549-1560 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08E

A combination of infrared images depicting areas of thermal emission and ground calibration points have proved to be particularly useful in plotting time-dependent changes in surface temperatures and radiance and in delimiting areas of predominantly convective heat flow to the earth's surface in the Cascade Range and on Surtsey Volcano, Iceland. In an integrated experiment group using ERTS-1 multispectral scanner (MSS) and aircraft infrared imaging systems in conjunction with multiple thermistor arrays, volcano surface temperatures are relayed daily to Washington via data communication platform (DCP) transmitters and ERTS-1. ERTS-1 MSS imagery has revealed curvilinear structures at Lassen, the full extent of which have not been previously mapped. Interestingly, the major surface thermal manifestations at Lassen are aligned along these structures, particularly in the Warner Valley. Author

N73-28370* New Mexico State Bureau of Mines and Mineral Resources, Socorro.
INITIAL EVALUATION OF THE GEOLOGIC APPLICATIONS OF ERTS-1 IMAGERY FOR NEW MEXICO
Karl VonderLinden and Frank E. Kottlowski *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1561-1566 ERTS (For availability see N73-28207 19-13)
CSCL 08G

Coverage of approximately one-third of the test site, the state of New Mexico, had been received by January 31, 1973 and all of the images received were MSS products. Features noted during visual inspection of 91/2 x 91/2 prints include major structural forms, vegetation patterns, drainage patterns and outcrops of geologic formations having marked color contrasts. The Border Hills Structural Zone and the Y-O Structural Zone are prominently reflected in coverage of the Pecos Valley. A study of available maps and remote sensing material covering the Deming-Columbus area indicated that the limit of detection and the resolution of MSS products are not as good as those of aerial photographs, geologic maps, and manned-satellite photographs. The limit of detection of high contrast features on MSS prints in approximately 1000 feet or 300 meters for linear features and about 18 acres for roughly circular areas. Author

N73-28371* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPUTED ATMOSPHERIC EFFECTS ON ERTS OBSERVATIONS
Robert S. Fraser *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1567-1573 refs ERTS (For availability see N73-28207 19-13)
CSCL 05B

The nadir radiances of many models of the earth atmosphere system were computed for a fixed solar zenith angle. These data indicate that the standard deviations of the multispectral scanner responses to changes in water vapor and aerosols would be small on a continental-wide basis. Author

N73-28372* Ohio Univ., Athens. Dept. of Geology.
MAPPING OF SOIL BANKS USING ERTS-1 PICTURES
Moid U. Ahmad, David A. Kantner, and John W. Antalovich (Kucera and Assoc., Inc., Mentor, Ohio) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1575-1582 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08B

Earth Resources Technology Satellite (ERTS-1) pictures of different wavelengths (MSS 4,5,6,7) were used in the study of two strip mine areas in southeastern Ohio. The first area was near Piedmont Lake and the second area was near New Lexington. Prints were examined under a binocular microscope and the gray tone was correlated with the actual ground conditions at several sites. For the New Lexington area, color infrared pictures taken at an elevation of 18,000 feet were also used for correlation with the ERTS-1 imagery. The results indicate that MSS 5 and 7 are most useful in defining the stripped land and show that the hydrological and soil characteristics are remarkably different than the surrounding lands. Author

N73-28373* Mitre Corp., McLean, Va.
AIR QUALITY INDICES FROM ERTS-1 MSS INFORMATION
Ellen L. Riley, Steven Stryker, and Edward A. Ward *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1583-1591 refs ERTS (For availability see N73-28207 19-13)
CSCL 04B

Comparison between ground based atmospheric turbidity

network measurements and the average scene grayness from MSS Channel 4 data is in progress. Correlation between these two sources is promising. If continued correlation occurs for other ERTS-1 overflight dates and ground test sites, a new operational use of ERTS-1 useful to Federal, state, and international organizations will become available. Author

N73-28374* Alaska Univ., Fairbanks.
SNOW COVER SURVEYS IN ALASKA FROM ERTS-1 DATA
Carl S. Benson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1593-1595 ERTS (For availability see N73-28207 19-13)
CSCL 08L

September and October ERTS scenes have been analyzed to delineate snow cover patterns in northern Alaska's Brooks Range and on Mt. Wrangell, and active volcano in South Central Alaska. ERTS images demonstrate that the snow on the northern foothills of the Brooks Range are significantly more affected by katabatic wind action than are the southern foothills. Aufeis deposits along arctic rivers also can be identified in late summer. A survey of such aufeis deposits could identify additional summertime sources of fresh water supplies. Images of Mt. Wrangell permit monitoring of the interaction between volcanic heat and the mass balance of glaciers that exist on active volcanoes. Temporal changes in the areas of bare rock on the rim of the caldera on the summit reveal significant melting of new snow from an extensive storm on August 18. Digital analysis of data from subsequent passes over the summit on September 7, 23 and 24 revealed considerable bare rock exposed by melting, which is virtually impossible from solar heating at this altitude and date. Author

N73-28375* Bendix Corp., Ann Arbor, Mich.
UTILIZATION OF ERTS-1 DATA TO MONITOR AND CLASSIFY EUTROPHICATION OF INLAND LAKES
Phillip E. Chase, Larry Reed, and V. Elliott Smith (Cranbrook Inst. of Sci.) *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1597-1604 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08H

A technique is being developed for use of ERTS in estimating and monitoring trophic levels of inland lakes. Preliminary findings are that Michigan lakes and ponds of one acre or more are resolvable in bands 5, 6 and 7 of NASA MSS imagery under fair conditions (haze and 70% cloud cover). In processed imagery (CCT) smaller features, including water color patterns, are evident within some lakes of 40 acres or more. Image distortion of lake size, shape, orientation, etc. is minimal; discrimination of lakes and ponds from various wetlands is good. Subsequent ERTS and aircraft imagery will be correlated with detailed ground truth of water color and quality in eutrophic test lakes. Author

N73-28376* National Environmental Satellite Services, Hillcrest Heights, Md.
ERTS-1 OBSERVES ALGAL BLOOMS IN LAKE ERIE AND UTAH LAKE
Alan E. Strong *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1605-1612 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08H

During late summer when the surface waters of Lake Erie reach their maximum temperature an algal bloom is likely to develop. Such phenomena have been noticed on other shallow lakes using ERTS-1 and characterize eutrophic conditions. The concentration of the algae into long streamers provides additional information on surface circulations. To augment the ERTS-1 MSS data of Lake Erie an aircraft was flown to provide correlative thermal-IR and additional multiband photographs. The algal bloom is highly absorptive in the visible wavelengths but reverses contrast with the surrounding water in the near-IR bands. The absorption of shortwave energy heats the dark brown algal mass, providing a hot surface target for the thermal-IR scanner. Author

N73-28377* Metropolitan Washington Council of Governments, D.C. Remote Sensing Project.
USE OF ERTS-1 DATA FOR REGIONAL PLANNING IN THE METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS: A SHORT BRIEF
Harry J. Mallon *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1613-1624 refs ERTS (For availability see N73-28207 19-13)
CSCL 05A

Land use and land use activity changes over discrete intervals of time represent basic data requirements in regional planning studies. Two examples of land use analysis required by the Council of Governments' transportation planning staff are described. Both were undertaken utilizing remote sensing imagery analysis. One study using large scale aircraft imagery developed a high degree of analytical detail and functional identification. The other, to support further detailed data base evaluation, utilizing ERTS-1 and small scale aircraft imagery, developed data identifying in more general detail major activity changes within the metropolitan region. Author

N73-28378* Alabama Univ., University. Dept. of Civil and Mineral Engineering.
LAND USE MAPPING AND CHANGE DETECTION USING ERTS IMAGERY IN MONTGOMERY COUNTY, ALABAMA
Richard Paul Wilms *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1625-1633 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)
CSCL 08B

The feasibility of using remotely sensed data from ERTS-1 for mapping land use and detecting land use change was investigated. Land use information was gathered from 1964 air photo mosaics and from 1972 ERTS data. The 1964 data provided the basis for comparison with ERTS-1 imagery. From this comparison, urban sprawl was quite evident for the city of Montgomery. A significant trend from forestland to agricultural was also discovered. The development of main traffic arteries between 1964 and 1972 was a vital factor in the development of some of the urban centers. Even though certain problems in interpreting and correlating land use data from ERTS imagery were encountered, it has been demonstrated that remotely sensed data from ERTS is useful for inventorying land use and detecting land use change. Author

N73-28379* Honeywell, Inc., Minneapolis, Minn. Systems and Research Div.
DETERMINATION OF LAND USE IN MINNESOTA BY AUTOMATIC INTERPRETATION OF ERTS MSS DATA
Raymond E. Zirkle and Deborah R. Pile *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1635-1639 Prepared in cooperation with Minnesota Univ., St. Paul ERTS (For availability see N73-28207 19-13)
CSCL 05B

This program aims to determine the feasibility of identifying land use in Minnesota by automatic interpretation of ERTS-MSS data. Ultimate objectives include establishment of land use delineation and quantification by computer processing with a minimum of human operator interaction. This implies not only that reflectivity as a function of calendar time can be catalogued effectively, but also that the effects of uncontrolled variables can be identified and compensated. Clouds are the major uncontrollable data pollutant, so part of the initial effort is devoted to determining their effect and the construction of a model to help correct or justifiably ignore affected data. Other short range objectives are to identify and verify measurements giving results of importance to land managers. Lake-counting is a prominent example. Open water is easily detected in band 7 data with some support from either band 4 or band 5 to remove ambiguities. Land managers and conservationists commission studies

periodically to measure water bodies and total water count within specified areas. Author

N73-28380* Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

DIGITAL DATA PROCESSING OF ERTS-1 IMAGERY OF DELAWARE BAY

Alfred C. Conrod *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1641-1647 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

CSCL 05B

A user-oriented Earth Resources Data Center is in operation at Bendix Aerospace, which a capable of automatically producing classification imagery and thematic maps from ERTS computer compatible tapes. The ERDC is now being used to process ERTS-1 data under a subcontract from the University of Delaware. ERTS coverage of Delaware Bay has been processed to produce classification imagery of water masses in the bay, and a map of all land-water boundaries along the shoreline including wetlands and inland lakes. Imagery, the user's video monitor color display, the data processing facility, and methodology are described. Author

N73-28381* Geological Survey, Flagstaff, Ariz. Museum of Northern Arizona.

THE USE OF PHOTOGRAPHIC METHODS IN CONTRAST ENHANCEMENT OF ERTS-1 IMAGES

Lawrence F. Harris *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1649-1659 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

CSCL 14E

The contrast of ERTS 70mm positive images can be enhanced to varying degrees by rephotographing the images with different types of negative films, and by overdeveloping the films with different developers. A combination of high contrast copy film (Kodak 5069) and a high energy developer (Kodak D-11) yields high contrast. Still greater contrast may be obtained by using a film of higher contrast capability and a developer of higher energy capability. Contrast can also be enhanced in the printing process with the use of highcontrast photographic papers, or with the use of polycontrast photographic paper and filters. Contrast enhancement by photocopying delineates topographic boundaries and may aid in the objective measurement of topographic parameters. Author

N73-28382* Earth Satellite Corp., Berkeley, Calif.

PRECISION ANNOTATION OF PREDETERMINED PRIMARY SAMPLING UNITS ON ERTS-1 MSS IMAGES

Jan W. VanRoessel and Philip G. Langley *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1661-1673 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

CSCL 05B

Resectioning programs were developed for projecting the boundary corners of sample units, management units, and counties into U2 RC-10 and ERTS-1 MSS images. The technique used includes corrections for earth curvature, terrain elevation, and MSS distortions. The minimum standard error obtained was about 0.15 mm or 150 meters on the ground. This technique now makes it possible to include land ownership as an integral part of forest resource sampling plans using ERTS imagery. Author

N73-28383* Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

UNSUPERVISED CLASSIFICATION AND AREAL MEASUREMENT OF LAND AND WATER COASTAL FEATURES ON THE TEXAS COAST

L. M. Flores, C. A. Reeves, S. B. Hixon, and J. F. Paris *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1675-1681 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

CSCL 08J

Multispectral scanner (MSS) digital data from ERTS-1 was used to delineate coastal land, vegetative, and water features in two portions of the Texas Coastal Zone. Data (Scene ID's 1037-16244 and 1037-16251) acquired on August 29, 1972, were analyzed on NASA Johnson Space Center systems through the use of two clustering algorithms. Seventeen to 30 spectrally homogeneous classes were so defined. Many classes were identified as being pure features such as water masses, salt marsh, beaches, pine, hardwoods, and exposed soil or construction materials. Most classes were identified to be mixtures of the pure class types. Using an objective technique for measuring the percentage of wetland along salt marsh boundaries, an analysis was made of the accuracy of areal measurement of salt marshes. Accuracies ranged from 89 to 99 percent. Aircraft photography was used as the basis for determining the true areal size of salt marshes in the study sites. Author

N73-28384* Department of the Environment, Victoria (British Columbia). Marine Sciences Directorate.

USE OF ERTS-1 PICTURES IN COASTAL OCEANOGRAPHY IN BRITISH COLUMBIA

J. F. R. Gower *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1683 ERTS (For availability see N73-28207 19-13)

CSCL 08J

The ERTS-1 color composite picture of the Vancouver-Victoria region illustrates the value of ERTS data for coastal oceanography. The water of the Fraser River plume which is so clearly visible in the center of the scene has been of interest to oceanographers on the west coast of Canada for a long time as an easily visible tracer of surface water circulation in the strait of Georgia. Maps of the plume at different states of the tide and with different river flow and weather were compiled from oblique aerial photographs in 1950 and used in the siting of sewage and other outfalls in the Vancouver area. More recently high level aerial photomosaics have been used to map the plume area, but the plume can spread over distances of 30 to 40 miles and many photographs, with the uneven illumination inherent in wide angle coverage, are needed for the mosaic. The ERTS satellite gives the first complete view of the plume area. Electronic enhancement of the images shows that the satellite's narrow angle coverage allows very weak surface turbidity features to be made visible to give information on surface currents over a wide area. Author

N73-28385* Bureau of Commercial Fisheries, Pascagoula, Miss. Southeast Fisheries Center.

RELATIONSHIPS BETWEEN REMOTELY SENSED FISHERIES DISTRIBUTION INFORMATION AND SELECTED OCEANOGRAPHIC PARAMETERS IN THE MISSISSIPPI SOUND

Andrew J. Kemmerer and Joseph A. Benigno *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1685-1695 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13)

CSCL 08A

A feasibility study to demonstrate the potential of satellites for providing fisheries significant information was conducted in the Mississippi Sound and adjacent offshore waters. Attempts were made to relate satellite acquired imagery to selected oceanographic parameters and then to relate these parameters to aircraft remotely sensed distribution patterns of resident surface schooling fishes. Initial results suggest that this approach is valid and that the satellite acquired imagery may have important fisheries resource assessment implications. Author

N73-28386* Army Coastal Engineering Research Center, Washington, D.C.

APPLICATION OF ERTS-1 IMAGERY IN COASTAL STUDIES

Orville T. Magoon, Dennis W. Berg, and Robert J. Hallermeier *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1697-1698 ERTS (For availability see N73-28207 19-13) CSCL 08C

The basic ERTS output is four black-and-white photographs presenting the same scene recorded in each multispectral scanner band. Mosaics covering large regions at a 1:250,000 scale can be compiled from these photographs. Office study of the image of each band separately, in combination with other bands, and in conjunction with other available data (navigation charts, tide tables, etc.) permits extraction of data useful in coastal engineering planning and coastal processes studies. Specific examples in which significant information on regional shoreline configuration or nearshore water movements has been obtained from unenhanced ERTS imagery are: (1) tidal inlet configuration; (2) navigation information; and (3) nearshore water movements. Author

N73-28387* Imperial Government of Iran, Tehran. Plan Organization.

APPLICATION OF ERTS-1 IMAGERY IN THE FIELDS OF GEOLOGY, AGRICULTURE, FORESTRY, AND HYDROLOGY TO SELECTED TEST SITES IN IRAN

Khosro Ebtehadj *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1699-1714 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13) CSCL 08G

The preliminary study of the ERTS-1 imagery coverage of Iran, commenced on October 26, 1972. All of the images were carefully examined, and a photomosaic covering approximately ninety-five per cent of the country was prepared. A number of images of selected areas were studied in detail. In the field of geology, a number of large scale faults were identified, which do not figure on geological maps. Furthermore, a preliminary study was carried out on the recent sediments, their possible sources, and origin. A limited number of geological work maps were prepared as well. In the fields of agriculture and forestry, studies based on color composite prints of certain areas were undertaken, with a purpose of identifying potential arable areas. Investigations in the field of water resources resulted in the discovery of a number of small lakes, and streams. Furthermore, fluctuations of the water level in some lakes were observed. Author

N73-28388* Geological Survey, Tampa, Fla.

DETECTION OF TURBIDITY DYNAMICS IN TAMPA BAY, FLORIDA USING MULTISPECTRAL IMAGERY FROM ERTS-1

A. E. Coker, Aaron Higer, and Carl R. Goodwin *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 1, Sect. A and B 1973 p 1715-1726 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28207 19-13) CSCL 08C

In 1970, Congress authorized the deepening of the Tampa Bay channel (Rivers and Harbors Act of 1970) from 34 to 44 feet. In order to determine the effects of this deepening on circulation, water quality, and biota, during and after the construction, the U.S. Geological Survey, in cooperation with the Tampa Port Authority, has collected data and developed a digital simulation model of the bay. In addition to data collected using conventional tools, use is being made of data collected from ERTS-1. Return beam vidicon (RBV) multispectral data were collected, while a shell dredging barge was operating in the bay, and used for turbidity recognition and unique spectral signatures representative of type and amount of material in suspension. A three-dimensional concept of the dynamics of the plume was achieved by superimposing the parts of the plume recognized in each RBV band. This provides a background for automatic computer processing of ERTS data and three-dimensional modeling of turbidity plumes. Author

N73-28389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SYMPOSIUM ON SIGNIFICANT RESULTS OBTAINED FROM EARTH RESOURCES TECHNOLOGY SATELLITE-1. VOLUME 2: SUMMARY OF RESULTS

Stanley C. Freden, ed., Enrico P. Mercanti, ed., and Donald E. Witten, ed. May 1973 205 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E73-10825; NASA-TM-X-66283; X-650-73-127) Avail: NTIS HC $12.25 CSCL 05B

The proceedings of a conference on the significant results obtained from ERTS-1 are presented. The subjects discussed include the following: (1) identification and mapping of soils, vegetation, and water resources in Texas using computer techniques, (2) geologic application of satellite imagery in Alaska, (3) multidisciplinary survey for management of Alaskan resources, and (4) application of satellite imagery to flood inundation mapping. For individual titles, see N73-28390 through N73-28404. Author

N73-28390* California State Government, Sacramento.

KEYNOTE ADDRESS

Ed Reinecke *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 5-12 ERTS (For availability see N73-28389 19-13) CSCL 05A

The keynote address of the conference on the significant results obtained by ERTS-1 is presented. The application of ERTS-1 imagery to the mapping of the state of California is stressed. Actions taken by the state executive branch in response to ERTS-1 data are discussed. The continued program and funding aspects of data utilization in developing California resources are reported. Author

N73-28391* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REVIEW OF ERTS-1 STATUS

William Nordberg *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 13-16 ERTS (For availability see N73-28389 19-13) CSCL 05B

A review of the ERTS-1 status and a description of the ERTS systems are presented. The manner in which the remote sensors receive information for transmission to ground stations is described. The orbit of the ERTS-1 is analyzed. The characteristics of the data and the processing procedures are reported. Specifications of the equipment aboard the satellite are defined. Author

N73-28392* Purdue Univ., Lafayette, Ind.

IDENTIFICATION AND MAPPING OF SOILS, VEGETATION, AND WATER RESOURCES OF LYNN COUNTY, TEXAS, BY COMPUTER ANALYSIS OF ERTS MSS DATA

Marion F. Baumgardner, Steven J. Kristof, and James A. Henderson, Jr. *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 17-30 An earlier version of this paper was published in Volume 1, pages 213-222 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13) CSCL 08B

Results of the analysis and interpretation of ERTS multispectral data obtained over Lynn County, Texas, are presented. The test site was chosen because it embodies a variety of problems associated with the development and management of agricultural resources in the Southern Great Plains. Lynn County is one of ten counties in a larger test site centering around Lubbock, Texas. The purpose of this study is to examine the utility of ERTS data in identifying, characterizing, and mapping soils, vegetation, and water resources in this semiarid region. Successful application of multispectral remote sensing and machine-processing techniques to arid and semiarid land-management problems will provide valuable new tools for the more than one-third of the world's lands lying in arid-semiarid regions. Author

N73-28393* Geological Survey, Washington, D.C.
PRELIMINARY GEOLOGIC APPLICATION OF ERTS-1 IMAGERY IN ALASKA
Ernest H. Lathram, Irvin L. Tailleur, William W. Patton, Jr., and William A. Fischer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 31-38 An earlier version of this paper was published in Volume 1, pages 257-264 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08G

The geologic application of ERTS-1 imagery in Alaska is discussed. The results of the investigation are relevant to the three national problems of: (1) identifying minable minerals, (2) accelerating the finding and development of sources of petroleum and gas, and (3) the need to preserve the environment. The use of ERTS-1 imagery in developing a netallogenetic map of Alaska is described. Illustrations of the accomplishments produced by ERTS-1 data are provided. Author

N73-28394* Alaska Univ., Fairbanks.
A MULTIDISCIPLINARY SURVEY FOR THE MANAGEMENT OF ALASKAN RESOURCES UTILIZING ERTS IMAGERY
John M. Miller and Albert E. Belon *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 39-50 An earlier version of this paper was published in Volume 1, pages 999-1006 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 05B

The application of ERTS-1 imagery for a multidisciplinary study of Alaskan resources is discussed. ERTS-1 data form a politically neutral base from which resource surveys can be made without arousing suspicions from groups which have mutually conflicting goals. The specific use of ERTS-1 imagery for monitoring migratory animals, pipeline locations, road construction, snow cover, and vegetation growth is reported. Maps, illustrations, and photographs are provided to support the data. Author

N73-28395* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF ERTS-1 IMAGERY TO FLOOD INUNDATION MAPPING
George R. Hallberg (Iowa Geol. Surv., Iowa City), Bernard E. Hoyer (Iowa Geol. Surv., Iowa City), and Albert Rango *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 51-70 refs An earlier version of this paper was published in Volume 1, pages 745-756 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08B

Ground data and a variety of low-altitude multispectral imagery were acquired for the East Nishnabotna River on September 14 and 15. This successful effort concluded that a near-visible infrared sensor could map inundated areas in late summer for at least three days after flood recession. ERTS-1 multispectral scanner subsystem (MSS) imagery of the area was obtained on September 18 and 19. Analysis of MSS imagery by IGSRSL, USGS, and NASA reinforced the conclusions of the low-altitude study while increasing the time period critical for imagery acquisition to at least 7 days following flood recession. The capability of satellite imagery to map late summer flooding at a scale of 1:250,000 is exhibited by the agreement of interpreted flood boundaries obtained from ERTS-1 imagery to boundaries mapped by low-altitude imagery and ground methods. Author

N73-28396* Oregon State Univ., Corvallis.
AGRICULTURE, FORESTRY AND RANGELAND RESOURCES
Charles E. Poulton *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 71-99 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08F

The application of ERTS-1 imagery for providing information on agriculture, forestry, and rangeland resources is described. The use of the ERTS-1 system for stratification and sampling estimates of relatively small areas is discussed. Examples of maps to improve resource definition for land use planning, resource allocation, and resource development are provided. Inventories of various crops, as determined by photointerpretation of ERTS imagery are submitted in tabular form. Author

N73-28397* Dartmouth Coll., Hanover, N.H.
LAND USE AND MAPPING
David T. Lindgren and Robert B. Simpson *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 100-105 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08B

From the standpoint of technology, the most encouraging thing about ERTS has been the level of land-use identification. Land-use detail has exceeded the expectations of the Interagency Steering Committee and the requirements of land-use classification proposed by the Department of Interior. Whereas in the latter instance it was anticipated that only nine classes of land use would probably be identifiable, in fact some 14 to 18 classes have been identified. The success in the level of land-use identification results primarily from the various attributes of the ERTS system. These include the ability to provide repetitive coverage, and in particular seasonal coverage; the ability to image in four bands of the electromagnetic spectrum (green, red, and two near-infrared), which allows for manipulation of various combinations of bands; and the provision by the ERTS system of computer-compatible tapes for machine processing of data. Furthermore, the resolution of ERTS imagery has been better than expected. Although there is some question as to its exact resolving power, it is safe to say objects as small as 100 meters (300 feet) in diameter have been identified. Linear features as narrow as 16 meters (50 feet) can be detected. Author

N73-28398* Cincinnati Univ., Ohio.
MINERAL RESOURCES, GEOLOGIC STRUCTURE, AND LANDFORM SURVEYS
Laurence H. Lattman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 107-114 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08B

The use of ERTS-1 imagery for mineral resources, geologic structure, and landform surveys is discussed. Four categories of ERTS imagery application are defined and explained. The types of information obtained by the various multispectral band scanners are analyzed. Samples of land use maps and tectoning and metallogenic models are developed. It is stated that the most striking features visible on ERTS imagery are regional lineaments, or linear patterns in the topography, which reflect major fracture zones extending upward from the basement of the earth.
Author

N73-28399* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WATER RESOURCES
Vincent V. Salomonson and Albert Rango *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. May 1973 p 115-126 Original contain color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08H

The application of ERTS-1 imagery to the conservation and control of water resources is discussed. The effects of exisiting geology and land use in the water shed area on the hydrologic cycle and the general characteristics of runoff are described. The effects of floods, snowcover, and glaciers are analyzed. The

use of ERTS-1 imagery to map surface water and wetland areas to provide rapid inventorying over large regions of water bodies is reported. Author

N73-28400* Corps of Engineers, Washington, D.C.
THE EARTH RESOURCES PROGRAM OF THE CORPS OF ENGINEERS
John W. Jarman *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 127-141 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08B

The mission of the Corps of Engineers of the U.S. Army and the contributions made by the ERTS-1 data system are discussed. The use of satellite-borne sensors and aerial photography for projects involving engineering geology, flood control, master planning, and fluid dynamics and interactions is reported. Examples of engineering projects are provided in the form of aerial photographs and multispectral band scanner imagery. Author

N73-28401* Geological Survey, Washington, D.C.
APPLICATION OF ERTS-1 RESULTS TO US DEPARTMENT OF INTERIOR PROGRAMS
John M. DeNoyer *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 142-145 ERTS (For availability see N73-28389 19-13)
CSCL 08F

The activities of the U.S. Department of Interior which have benefited from ERTS-1 data are described. It is stated that the primary interest is in the area of land use. Legislative actions regarding land use are reported. Programs involving renewable resources are stressed. Author

N73-28402* Woods Hole Oceanographic Institution, Mass.
A PRELIMINARY ASSESSMENT OF ERTS IMAGERY FOR MARINE RESOURCES
Gifford C. Ewing *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 146-150 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08A

The application of ERTS-1 imagery to identifying marine resources is discussed. Specific reference is made to the use of ERTS-1 for observing the onset of the spring growing season in the ocean while it occurs. ERTS-1 data is used for the following purposes: (1) location of large areas of seasonally variable biological activity, (2) measurement of water depth in shallow seas, (3) monitoring of sewer discharges, (4) assessment of erosion damage to beaches and shoreline installations, and (5) navigation through ice-filled waterways. Author

N73-28403* California Univ., Davis.
APPLICATION OF ERTS-1 DATA TO AID IN SOLVING WATER RESOURCES MANAGEMENT PROBLEMS IN THE STATE OF CALIFORNIA
Robert H. Burgy *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 151-166 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08H

Investigations within the State of California have emphasized the direct utilization of the supplemental data source afforded by the Earth Resources Technology Satellite-1 (ERTS-1) imagery. A user-oriented study has been underway for several years to identify and develop application methodology for remotely sensed information available from several platform levels, including low and high flights by NASA's U2 aircraft, and other manned and unmanned devices. The University of California has pursued both basic and applied research in remote sensing, through ongoing studies supported by NASA, and in cooperation with state agencies responsible for water resources and related fields. This report reviews the applications of ERTS-1 and supplementary imagery sources applicable to water resources planning, operations, and management. Author

N73-28404* Mississippi State Office of Science and Technology, Jackson.
APPLICATION OF ERTS RESULTS TO LAND AND RESOURCE MANAGEMENT IN THE STATE OF MISSISSIPPI
Preston T. Bankston *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 2 May 1973 p 167-181 Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (For availability see N73-28389 19-13)
CSCL 08B

The application of ERTS-1 data to land and resource management in the State of Mississippi is discussed. Land use maps using various types of photographic imagery are provided to describe the nature of the engineering projects being conducted Examples of forest maps and wildlife habitat maps are included. Some of the problems involved in applying the ERTS imagery to specific activities are reported. Author

N73-28405*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYMPOSIUM ON SIGNIFICANT RESULTS OBTAINED FROM EARTH RESOURCES TECHNOLOGY SATELLITE-1. VOLUME 3: DISCIPLINE SUMMARY REPORTS
Stanley C. Freden, ed. and Enrico P. Mercanti, ed. May 1973 122 p refs ERTS
(E73-10826; NASA-TM-X-66284; X-650-73-155) Avail: NTIS HC $8.25 CSCL 05B

Discipline summary reports are presented for significant results obtained from ERTS-1 investigations. Discipline areas covered are: (1) agriculture, forestry, and range resources; (2) land use and mapping; (3) mineral resources, geological structure, and landform surveys; (4) environment surveys; (5) water resources; (6) marine resources and ocean surveys; (7) interpretation techniques development; and (8) multidisciplinary/regional resource surveys. For individual titles, see N73-28406 through N73-28413.

N73-28406* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRICULTURE, FORESTRY, RANGE RESOURCES
William Crea *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 1-17 refs ERTS (For availability see N73-28405 19-13)
CSCL 08F

Significant results obtained from ERTS-1 observations of agriculture, forestry, and range resources are summarized. Four major parts are covered: (1) crop classification and mensuration; (2) timber and range resources survey and classification; (3) soil survey and mapping; and (4) subdiscipline areas. A.L.

N73-28407* Mississippi Test Facility, Bay St. Louis.
LAND USE AND MAPPING
D. Wayne Mooneyhan *In* NASA. Goddard Space Flight Center Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 19-29 refs ERTS (For availability see N73-28405 19-13)
CSCL 08B

Applications of ERTS-1 data and imagery in the fields of land use and mapping are summarized. Three areas are investigated and discussed: (1) mapping investigations; (2) land use inventory/image interpretation techniques; and (3) land use investigations/automatic pattern recognition techniques. A.L.

N73-28408* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MINERAL RESOURCES, GEOLOGICAL STRUCTURE AND LANDFORM SURVEYS
Nicholas M. Short *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 30-46 refs ERTS (For availability see N73-28405 19-13)
CSCL 08G

Significant results are presented of ERTS-1 investigations of

landform surveys, mineral resources, and geological structures. The report covers four areas: (1) mapping investigations; (2) dynamic surface processes and landforms; (3) structural elements; and (4) mineral deposits. A.L.

N73-28409* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENT SURVEYS
Louis S. Walter *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 47-56 refs ERTS
(For availability see N73-28405 19-13)
CSCL 13B

The applications of ERTS-1 in the investigation of environmental quality and pollution are reviewed. Problem areas discussed are: (1) air pollution; (2) water pollution; (3) land pollution; and (4) aesthetics. A.L.

N73-28410* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WATER RESOURCES
Vincent V. Salomonson *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 57-70 refs ERTS
(For availability see N73-28405 19-13)
CSCL 08H

Uses of ERTS-1 imagery and data for water resources surveys and management are summarized. Areas discussed are: (1) land use and geology; (2) flood plain and flood inundation mapping; (3) snow cover mapping; (4) glacier observations; (5) data collection systems; (6) surface waters; (7) wetlands mapping; (8) water quality; (9) soil mapping; (10) phreatophyte and riparian vegetation mapping; and (11) evapotranspiration. A.L.

N73-28411* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARINE RESOURCES AND OCEAN SURVEYS
James R. Greaves *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 71-82 refs ERTS
(For availability see N73-28405 19-13)
CSCL 08A

A synopsis of significant results achieved within the marine resources and ocean surveys discipline of the overall ERTS program is provided. Summaries are provided of the following subdisciplines: (1) coastal processes; (2) bathymetry; (3) sea ice; (4) oceanic circulation and dynamics; and (5) living marine resources. A.L.

N73-28412* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPRETATION TECHNIQUES DEVELOPMENT
William L. Alford *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 83-94 refs ERTS
(For availability see N73-28405 19-13)
CSCL 05B

The processes, algorithms and procedures for extraction and interpretation of ERTS-1 data are discussed. Analysis of data acquired temporally is possible through geometric correction, correlation, and registration techniques. The powerful techniques in image enhancement developed for the lunar and planetary programs are valuable for Earth Resources Survey programs. There is evidence that both optical and digital methods of spatial information extraction can provide valuable sources of data information the ERTS system. The techniques available, even for a limited number of bands and limited resolution can be effectively used to extract much of the information required by resource managers. Author

N73-28413* + National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
MULTIDISCIPLINARY/REGIONAL RESOURCE SURVEYS
Gilmore H. Trafford *In its* Symp. on Significant Results obtained from the ERTS-1, Vol. 3 May 1973 p 95-101 refs ERTS
(For availability see N73-28405 19-13)
Avail: NTIS CSCL 08F

The multidisciplinary/regional resource surveys summary is presented in four parts: land use, geologic interpretation, resource survey, and pollution monitoring. Significant results derived from ERTS-1 imagery and data for these four disciplines are briefly reviewed and summarized. A.L.

N73-28414*# Cornell Univ., Ithaca, N.Y. Dept. of Natural Resources.
EVALUATION OF SATELLITE IMAGERY AS AN INFORMATION SERVICE FOR INVESTIGATING LAND USE AND NATURAL RESOURCES (SKYLAB) Progress Report, 1 May - 31 Jul. 1973
Ernest E. Hardy, Principal Investigator 31 Jul. 1973 1 p EREP
(Contract NAS9-13364)
(E73-10829; NASA-CR-133334) Avail: NTIS HC $3.00 CSCL 08B

There are no author-identified significant results in this report.

N73-28415*# Colorado School of Mines, Golden. Dept. of Geology.
GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO Progress Report, 1 Jun. - 31 Jul. 1973
Daniel H. Knepper, Jr., Principal Investigator 30 Jul. 1973 3 p ERTS
(Contract NAS5-21778)
(E73-10837; NASA-CR-133397) Avail: NTIS HC $3.00 CSCL 08G

There are no author-identified significant results in this report.

N73-28416*# Tulane Univ., New Orleans, La.
PRELIMINARY STUDY OF LAKE PONTCHARTRAIN AND VICINITY USING REMOTELY SENSED DATA FROM THE ERTS-A SATELLITE Progress Report
John U. Hidalgo, Principal Investigator, Alfred E. Smalley, Kenneth H. Faller, and Mary B. Irvin 15 Jul. 1973 6 p ERTS
(Contract NAS5-21740)
(E73-10838; NASA-CR-133398) Avail: NTIS HC $3.00 CSCL 08H

There are no author-identified significant results in this report.

N73-28417*# Earth Satellite Corp., Berkeley, Calif.
A SCHEME FOR THE UNIFORM MAPPING AND MONITORING OF EARTH RESOURCES AND ENVIRONMENTAL COMPLEXES USING ERTS-1 IMAGERY Progress Report, 1 Jan. - 30 Jun. 1973
Charles E. Poulton, Principal Investigator 31 Jul. 1973 41 p
Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21830)
(E73-10839; NASA-CR-133399; PR-2) Avail: NTIS HC $4.25 CSCL 08B

There are no author-identified significant results in this report.

N73-28418*# Alaska Univ., Fairbanks. Alaska Cooperative Wildlife Research Unit.
APPLICATION OF ERTS-1 IMAGERY TO THE STUDY OF CARIBOU MOVEMENTS AND WINTER DISPERSAL IN RELATION TO PREVAILING SNOWCOVER Progress Report, Jan. - Jul. 1973
Peter C. Lent and Arthur J. LaPerriere, Principal Investigators 31 Jul. 1973 14 p ERTS
(Contract NAS5-21833)
(E73-10840; NASA-CR-133402) Avail: NTIS HC $3.00 CSCL 06C

There are no author-identified significant results in this report.

N73-28419*# Alaska Univ., Fairbanks. Dept. of Geology.
ERTS-1 DATA AS A TEACHING AND RESEARCH TOOL IN THE DEPARTMENT OF GEOLOGY Semiannual Technical Report, Feb. - Jul. 1973
Donald Grybeck, Principal Investigator 31 Jul. 1973 7 p ERTS
(Contract NAS5-21833)
(E73-10841; NASA-CR-133403; SATR-2) Avail: NTIS HC $3.00 CSCL 05I

The author has identified the following significant results.

During the sixth bi-monthly period, a mosaic was constructed in MSS band 6 of the southeastern one-half of Alaska. A mosaic of the whole state awaits additional coverage to fill in some gaps. In addition, new material is being monitored as it arrived at the Geophysical Institute and from the NASA Indices for inclusion into the departmental collections. No geology courses are being taught during the summer.

N73-28420*# Alaska Univ., Fairbanks. Geophysical Inst.
EVALUATION OF FEASIBILITY OF MAPPING SEISMICALLY ACTIVE FAULTS IN ALASKA Progress Report, Feb. - Jul. 1973
Larry Gedney and James D. VanWormer, Principal Investigators 31 Jul. 1973 13 p refs ERTS
(Contract NAS5-21833)
(E73-10842; NASA-CR-133404) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. The sharp bend in the Alaska Range near 65 deg N, 150 deg W in now thought to enclose a corner of the northwesterly migrating north Pacific lithospheric plate. Subduction of the plate beneath the continent is believed, on the basis of hypocentral distribution, to occur along Cook Inlet and the eastern flanks of the Aleutian and Alaska Ranges as far northward as Mt. McKinley. The nature of tectonic deformation here; particularly in the area of the bend in the Alaska Range, is understandably complex. The Denali fault is thought to be a transform character in the vicinity of Mt. McKinley (i.e., it is thought to be the surface along which the oceanic plate separates from the continental plate). On the ERTS-1 imagery, however, it appears that there are a number of sub-parallel faults which branch off of the Denali fault in a southwesterly direction. Slippage along these would tend to squeeze material around the inside of the band rather than the plate being directly underthrust. All of these sub-parallel faults are seismically active. The right-lateral fault-plane solution obtained for this event is consistent with the concept of slippage around the bend on a set of sub-parallel faults in the manner postulated. The best images to show these features are 1066-20444 and 1266-20572.

N73-28421*# Tennessee Univ., Knoxville. Dept. of Geography.
APPLICATIONS OF ERTS-1 DATA TO LANDSCAPE CHANGE IN EASTERN TENNESSEE
John B. Rehder, Principal Investigator 31 Jul. 1973 13 p refs Proposed for presentation at Symp. on Management and Utilization of Remote Sensing Data, Sioux Falls, S. D., 29 Oct. - 2 Nov. 1973; sponsored by Am. Soc. of Photogrammetry Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21726)
(E73-10843; NASA-CR-133422) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. The analysis of landscape change in eastern Tennessee from ERTS-1 data is being derived from three avenues of experimentation and analysis: (1) a multi-stage sampling procedure utilizing ground and aircraft imagery for ground truth and control; (2) a densitometric and computer analytical experiment for the analysis of gray tone signatures and comparisons for landscape change detection and monitoring; and (3) an ERTS image enhancement procedure for the detection and analysis of photomorphic regions. Significant results include: maps of strip mining changes and forest inventory, watershed identification and delimitation, and agricultural regions derived from spring plowing patterns appearing on the ERTS-1 imagery.

N73-28422*# Wyoming Univ., Laramie. Dept. of Geology.
ANALYSIS OF ERTS-1 IMAGERY AND ITS APPLICATION TO EVALUATION OF WYOMING'S NATURAL RESOURCES Progress Report, Jan. - Jun. 1973
Robert S. Houston, Principal Investigator and Ronald W. Marrs 20 Jul. 1973 19 p refs ERTS
(Contract NAS5-21799)
(E73-10844; NASA-CR-133423) Avail: NTIS HC $3.00 CSCL 08F

The author has identified the following significant results. Significant results of the Wyoming ERTS-1 investigation during the first six months (July-December 1972) included: (1) successful segregation of Precambrian metasedimentary/metavolcanic rocks from igneous rocks, (2) discovery of iron formation within the metasedimentary sequence, (3) mapping of previously unreported tectonic elements of major significance, (4) successful mapping of large scale fracture systems of the Wind River Mountains, (5) successful distinction of some metamorphic, igneous, and sedimentary lithologies by color additive viewing, (6) mapping of large scale glacial features, and (7) development of techniques for mapping small urban areas.

N73-28423*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF ERTS-1 DATA TO THE PROTECTION AND MANAGEMENT OF NEW JERSEY'S COASTAL ENVIRONMENT Progress Report, Jan. - Jul. 1973
Roland S. Yunghans, Principal Investigator, Edward B. Feinberg, Robert L. Mairs, Frank J. Wobber, Kenneth R. Martin, Lawrence R. Pettinger, and Robert T. Macomber Jul. 1973 151 p Prepared for New Jersey Dept. of Environmental Protection, Trenton Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21765)
(E73-10845; NASA-CR-133424; ESC-304) Avail: NTIS HC $9.75 CSCL 08C

The author has identified the following significant results. Analysis of ERTS-1 imagery and complementary aircraft overflights has led to the development of seventeen information products that are being utilized within the Department of Environmental Protection as new sources of information for coastal zone management. Problem areas of significance to the State, and in which product development has contributed to date, have been identified as: the environmental effects of offshore waste disposal, the placement of ocean outfalls, the better understanding of littoral processes for shore protection, the delineation of the coastal ecozones, and determination of the flushing characteristics of the State's estuaries. Of equal importance has been the development of a capability within the State to use and understand remote sensor-derived information.

N73-28424*# New York State Museum and Science Service, Albany.
TO EVALUATE ERTS-1 DATA FOR USEFULNESS AS A GEOLOGICAL SENSOR IN THE DIVERSE GEOLOGICAL TERRAINES OF NEW YORK STATE Progress Report, period ending 15 Aug. 1973
Yngvar W. Isachsen, Principal Investigator 16 Aug. 1973 8 p ERTS
(Contract NAS5-21764)
(E73-10846; NASA-CR-133425) Avail: NTIS HC $3.00 CSCL 08G

The author has identified the following significant results. Linear anomalies dominate the new geological information derived from ERTS-1 imagery, total lengths now exceeding 6000 kms. Experimentation with a variety of viewing techniques suggests that conventional photogeologic analyses of band 7 results in the location of more than 97 percent of all linears found. Bedrock lithologic types are distinguishable only where they are topographically expressed or govern land use signatures. The maxima on rose diagrams for ERTS-1 anomalies correspond well with those for mapped faults and topographic lineaments, despite a difference in relative magnitudes of maxima thought due to solar illumination direction. A multiscale analysis of linears showed that single topographic linears at 1:2,500,000 became dashed jugate linears at 1:500,000, and shorter linears lacking any conspicuous zonal alignment at 1:250,000. Most circular features found were explained away by U-2 airphoto analysis but several remain as anomalies. Visible glacial features include individual drumlins, best seen in winter imagery, drumlinoids, eskers, ice-marginal drainage channels, glacial lake shorelines and sand plains, and end moraines.

N73-28425*# Naval Research Lab., Washington, D.C.
DETERMINATION OF SEA SURFACE CONDITIONS USING SKYLAB L-BAND AND RADSCAT PASSIVE MICROWAVE RADIOMETERS Monthly Progress Report
James P. Hollinger, Principal Investigator 23 Jul. 1973 2 p

EREP
(NASA Order T-4126-B)
(E73-10847; NASA-CR-133426) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-28426*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL ANALYSIS OF SURFACE FEATURES IN THE STUDY OF THE EVOLUTION OF BARRIER ISLANDS
N. H. MacLeod, Principal Investigator (Am. Univ., Washington, D. C.), J. Schubert (Am. Univ., Washington, D. C.), and A. Anderson [1973] 1 p ERTS
(E73-10848; NASA-TM-X-69368) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-28427*# Tennessee Univ., Knoxville.
UTILIZATION OF ERTS DATA TO DETECT PLANT DISEASES AND NUTRIENT DEFICIENCIES, SOIL TYPES AND MOISTURE LEVELS Progress Report
W. L. Parks, J. I. Sewell, J. W. Hilty, and J. C. Rennie, Principal Investigators 8 Aug. 1973 3 p ERTS
(Contract NAS5-21873)
(E73-10849; NASA-CR-133427; PR-5) Avail: NTIS HC $3.00 CSCL 02A

The author has identified the following significant results. The separation of the Mississippi Delta from the Memphis Association (Loess) is clearly defined in ERTS-1 imagery covering west Tennessee and Mississippi.

N73-28428*# Geological Survey, Washington, D.C.
ERTS-MSS DIGITAL DATA, FIELD SPECTRAL MEASUREMENTS, AND MULTIBAND PHOTOGRAPHY FOR WETLANDS VEGETATION ANALYSIS
Virginia Carter and Jane Schubert (Am. Univ., Washington, D. C.) [1973] 1 p Sponsored by NASA ERTS
(E73-10850; NASA-CR-133428) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-28429*# Old Dominion Univ. Research Foundation, Norfolk, Va.
INVESTIGATION TO RELATE THE CHLOROPHYLL AND SUSPENDED SEDIMENT CONTENT IN THE WATERS OF THE LOWER CHESAPEAKE BAY TO ERTS-1 IMAGERY Bimonthly Report, 1 Apr. - 31 May 1973
Peter Fleischer, John C. Ludwick, T. A. Gosink, David Bowker, Principal Investigators, and W. J. Hanna 13 Aug. 1973 2 p ERTS
(Contract NAS5-21816)
(E73-10851; NASA-CR-133439) Avail: NTIS HC $3.00 CSCL 08J

There are no author-identified significant results in this report.

N73-28430*# TRW Systems Group, Redondo Beach, Calif.
ERTS IMAGE DATA COMPRESSION TECHNIQUE EVALUATION Monthly Progress Report, period ending 1 Aug. 1973
Donald J. Spencer, Principal Investigator and Curtis L. May 8 Aug. 1973 2 p ERTS
(Contract NAS5-21746)
(E73-10853; NASA-CR-133441) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-28431*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ERTS-A IMAGERY INTERPRETATION TECHNIQUES IN THE TENNESSEE VALLEY Progress Report, 25 May - 25 Jul. 1973
Robert E. Bodenheimer, Principal Investigator 4 Aug. 1973 2 p ERTS
(Contract NAS5-21875)
(E73-10854; NASA-CR-133442) Avail: NTIS HC $3.00 CSCL 05B

There are no author-identified significant results in this report.

N73-28432*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
MACHINE PROCESSING OF ERTS AND GROUND TRUTH DATA
Robert H. Rogers, Principal Investigator and Keith Peacock 7 Aug. 1973 14 p refs Proposed for presentation at Conf. on Machine Processing of Remotely Sensed Data, Lafayette, Ind., 16-18 Oct. 1973; sponsored by Purdue Univ. ERTS
(Contract NAS5-21863)
(E73-10855; NASA-CR-133443) Avail: NTIS HC $3.00 CSCL 05B

The author has identified the following significant results. Results achieved by ERTS-Atmospheric Experiment PR303, whose objective is to establish a radiometric calibration technique, are reported. This technique, which determines and removes solar and atmospheric parameters that degrade the radiometric fidelity of ERTS-1 data, transforms the ERTS-1 sensor radiance measurements to absolute target reflectance signatures. A radiant power measuring instrument and its use in determining atmospheric parameters needed for ground truth are discussed. The procedures used and results achieved in machine processing ERTS-1 computer -compatible tapes and atmospheric parameters to obtain target reflectance are reviewed.

N73-28433*# Maine State Highway Dept., Bangor.
DETECTION AND MONITORING VEGETATION DAMAGE ASSOCIATED WITH HIGHWAY FACILITIES Progress Report, period ending 1 Jul. 1973
E. G. Stoeckeler, Principal Investigator Jul. 1973 3 p ERTS
(Contract NAS5-21724)
(E73-10856; NASA-CR-133444; PR-7) Avail: NTIS HC $3.00 CSCL 08F

There are no author-identified significant results in this report.

N73-28434*# Environmental Research and Technology, Inc., Lexington, Mass.
EXPERIMENTAL EVALUATION OF ATMOSPHERIC EFFECTS ON RADIOMETRIC MEASUREMENT USING THE EREP OF SKYLAB Quarterly Progress Report
David T. Chang, Principal Investigator 7 Aug. 1973 2 p EREP
(Contract NAS9-13343)
(E73-10857; NASA-CR-133445; QPR-1) Avail: NTIS HC $3.00 CSCL 03B

There are no author-identified significant results in this report.

N73-28435*# California Univ., Riverside. Citrus Research Center/Agricultural Experiment Station.
EVALUATION OF REMOTE SENSING IN CONTROL OF PINK BOLLWORM IN COTTON
Lowell N. Lewis, Principal Investigator, Virginia B. Coleman, and Claude W. Johnson 8 Aug. 1973 8 p Presented at the ERTS-1 Symp., Mar. 1973 and at the ann. meetings of the Assoc. of Pacific Coast Geographers, Jun. 1973 Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21771)
(E73-10858; NASA-CR-133446) Avail: NTIS HC $3.00 CSCL 02C

The author has identified the following significant results. This project is to identify and map cotton fields in the southern deserts of California. Cotton in the Imperial, Coachella, and Palo Verde Valleys is heavily infested by the pink bollworm which affects both the quantity and quality of cotton produced. In California the growing season of cotton is regulated by establishing planting and plowdown dates. These procedures ensure that the larvae, whose diapause or resting period occurs during the winter months, will have no plant material on which to feed, thus inhibiting spring moth emergence. The underflight data from the U-2 aircraft has shown that it is possible to detect the differences

between a growing, a defoliated, and plowed down field providing the locations of the fields are known. The ERTS-1 MSS data are being analyzed using an I2S optical color combiner to determine which combinations of dates and colors will identify cotton fields and thus provide the data needed to produce maps of the fields for the forthcoming season.

N73-28436# Consiglio Nazional delle Ricerche, Bologna (Italy). Ist. di Fisica dell'Atmosfera.
THE BUDRIO STATION OF THE METEOROLOGICAL RADAR SYSTEM FOR THE SYSTEMATIC STUDY OF THE UPPER ATMOSPHERE
F. Verniani, G. Sinigaglia (Bologna Univ.), M. Schaffner Smithsonian Astrophys. Obs.), S. Gottardi, C. Franceschi, C. Formiggini, A. Dardi, and Bortolotti Mar. 1973 34 p refs In ITALIAN; ENGLISH summary
(IFA-CP-289) Avail: NTIS HC $3.75

The Budrio radar station and the principles of the methods employed are described. The station is discussed in terms of an international network for synoptic studies of the atmosphere.
Transl. by F.O.S.

N73-28437# Royal Greenwich Observatory, Herstmonceux (England).
GREENWICH TIME REPORT: TIME AND LATITUDE SERVICE, OCTOBER - DECEMBER 1972
Dec. 1972 17 p
Avail: NTIS HC $3.00

The results of the Greenwich Time and Latitude Service for the period 1972 October to December inclusive are given in tabular form.
Author

N73-28438# Weapons Research Establishment, Salisbury (Australia).
THERMOSPHERIC OBSERVATIONS COMBINING CHEMICAL SEEDING AND GROUND BASED TECHNIQUES. PART 2: IONOSPHERIC DRIFTS AND THE Sq CURRENT SYSTEM
K. H. Lloyd, C. H. Low (Adelaide Univ.), D. G. Felgate (Univ. Coll., London), D. Rees (Max-Planck-Inst. for Extraterrestrial Physics), and G. Haerendel Feb. 1973 25 p refs
(WRE-TN-680(WR/D)-Pt-2) Avail: NTIS HC $3.25 CSCL 04A

Two Skylark sounding rockets carrying chemical seeding payloads were launched from Woomera, South Australia in October 1969. In conjunction with these firings, the F region drifts were determined with the Buckland Park Aerial Array. Differences between the ionospheric Sq current systems deduced from the observed inonspheric parameters, and from ground based magnetograms are discussed, and the results of the F region drift radio method are compared with the observed drift of the barium clouds.
Author

N73-28439*# Kanner (Leo) Associates, Redwood City, Calif.
AMINO ACIDS CONTAINED IN THE CENOZOIC FORMATIONS OF JAPAN
Yuko Chihara Washington NASA Jul. 1973 28 p refs Transl. into ENGLISH from Chikyu Kagaku (Tokyo), v. 26, no. 2, Mar. 1972 p 69-79
(Contract NASw-2481)
(NASA-TT-F-15002) Avail: NTIS HC $3.50 CSCL 08D

The concentration, composition, and other aspects of amino acids present in the Cenozoic formations of Japan are clarified. The samples used were mainly muddy samples, collected from representative Cenozoic formations. Various conclusions were drawn: (1) amino acid concentration diminishes as the geological age of the formation gets older, (2) amino acid concentration is high in clayey and low in sandy sediments, (3) nineteen kinds of amino acids were detected, 17 of which were alpha-amino acids, (4) amino acid composition percentage is similar in all the samples, and (5) It was supposed that amino sugars are widely present with amino acids in the Cenozoic formations.
Author

N73-28440*# Scientific Translation Service, Ann Arbor, Mich.
AEROMETHODS OF GEOGRAPHICAL RESEARCH
L. A. Bogomolov, ed. and E. M. Pospelov, ed. Washington NASA Jul. 1973 54 p refs Transl. into ENGLISH of the publ. "Aerometody Geograficheskikh Issledovaniy" Moscow, Geograph. Soc. of the USSR, 1972 p 1-39
(Contract NASw-2483)
(NASA-TT-F-14966) Avail: NTIS HC $4.75 CSCL 08E

Thirteen papers on aerospace photographic methods, presented at the Moscow Branch of the Geographic Society in 1970-1972, are presented. The topics include: exchange of experience, appropriate scientific research, literature surveys on foreign aerial and space surveys, reports on foreign meetings, applications to agriculture, and geology photogrammetry. Author

N73-28441*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIRECT OBSERVATIONS IN THE DUSK HOURS OF THE CHARACTERISTICS OF THE STORM-TIME RING CURRENT PARTICLES DURING THE BEGINNING OF MAGNETIC STORMS
Paul H. Smith and R. A. Hoffman Aug. 1973 28 p refs Submitted for publication
(NASA-TM-X-70430; X-646-73-228) Avail: NTIS HC $3.50 CSCL 04A

The characteristic features of the initial enhancement of the storm-time ring current particles in the evening hours are consistent with flow patterns resulting from a combination of inward convection, gradient drift, and corotation which carries plasma sheet protons into low L-values near midnight and the higher energy proton component into the plasmasphere and through the evening hours. Data from four magnetic storms during the early life of Explorer 45, when the local time of apogee was in the afternoon and evening hours, show that protons with lower magnetic moments penetrate deeper into the magnetosphere until a low limit, determined by the corotation and gradient drift forces, is reached. Such particle motions produce the stable energy dependent inner boundary of the ring current protons inside the plasmapause in the dusk sector and also provide the mechanism for energy injection into the ring current region. From the analyses of the pitch angle distributions it is evident that charge exchange and wave particle interactions are not the dominant causes of this inner boundary.
Author

N73-28442*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE BEHAVIOR OF THE PLASMAPAUSE AT MID-LATITUDES: ISIS-1 LANGMUIR PROBE MEASUREMENTS
L. H. Brace and R. F. Theis Apr. 1973 48 p refs Submitted for publication
(NASA-TM-X-70429; X-621-73-220) Avail: NTIS HC $4.50 CSCL 04A

Observations of the electron concentration, N sub e, and temperature, T sub e, from the electrostatic probes on the ISIS-1 satellite were used to examine the location and behavior of the plasmapause at about 3000 kilometers altitude in the vicinity of L = 4. At these altitudes, the N sub e measurements are equivalent to measurements of H(+) since the satellite is well into the protonosphere. The plasmapause as is evident as a sharp drop in N sub e by a factor of 10 to 100 as the satellite passes into the polar cap, and a corresponding increase is observed as it enters the plasmasphere on the opposite side of the Earth. An enhancement of T sub e is also observed at the plasmapause, an effect that is most visible at night when the temperatures at latitudes above and below the plasmapause are usually very low. The position of the plasmapause decreases with magnetic activity but is found to be somewhat less sensitive to K sub p than is the equatorial plasmapause. Also unlike its equatorial behavior, the mid-latitude plasmapause exhibits no detectable late afternoon bulge. These differences imply rather complex coupling of the thermal plasma along the field lines that link these two regions of the plasmasphere. An additional factor may be the recently observed axial asymmetry in the geomagnetic field at high altitudes.
Author

N73-28443*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF EDDY TURBULENCE IN THE DEVELOPMENT OF SELF-CONSISTENT MODELS OF THE LOWER AND UPPER THERMOSPHERE
S. Chandra and A. K. Sinha (Md. Univ., College Park) Aug.

1973 33 p refs Submitted for publication
(NASA-TM-X-70431; X-621-73-229) Avail: NTIS HC $3.75 CSCL 04A

Numerical solutions of mutually coupled time dependent equations of continuity, momentum and energy balance are presented to illustrate the effect of eddy turbulence on the neutral composition and temperature of the lower and upper atmosphere. The procedure adopted eliminates the necessity of making ad-hoc assumptions about the conditions at the turbopause level and allows the study of the two regions in a self-consistent manner. From the illustrative examples comprising parametric changes in the eddy diffusion coefficient, the specific roles of eddy turbulence in the development of theoretical models of the thermosphere are discussed. Author

N73-28444*# California Inst. of Tech., Pasadena.
A NEW TWO-METRIC THEORY OF GRAVITY WITH PRIOR GEOMETRY
Alan P. Lightman and David L. Lee [1972] 54 p refs
(Grants NGR-05-002-256; NSF GP-36687X; NSF GP-28027) Avail: NTIS HC $4.75 CSCL 08N

A theory is presented of gravity which has the same post-Newtonian (PN) as that of general relativity. The field equations, and a calculation of the PN limit of the theory are discussed along with the equations of stellar structure for static spherically symmetric stars. A special exterior spherically symmetric solution, time dependent solutions, conservations, and gravitational waves are analyzed. F.O.S.

N73-28445*# California Univ., Berkeley. Space Sciences Lab.
STATIC PENETRATION RESISTANCE OF SOILS
H. Turan Durgunoglu and James K. Mitchell Apr. 1973 243 p
(Grant NGR-05-003-406)
(NASA-CR-133460; SSL-Ser-14-Issue-24) Avail: NTIS HC $14.25 CSCL 08M

Model test results were used to define the failure mechanism associated with the static penetration resistance of cohesionless and low-cohesion soils. Knowledge of this mechanism has permitted the development of a new analytical method for calculating the ultimate penetration resistance which explicitly accounts for penetrometer base apex angle and roughness, soil friction angle, and the ratio of penetration depth to base width. Curves relating the bearing capacity factors to the soil friction angle are presented for failure in general shear. Strength parameters and penetrometer interaction properties of a fine sand were determined and used as the basis for prediction of the penetration resistance encountered by wedge, cone, and flat-ended penetrometers of different surface roughness using the proposed analytical method. Because of the close agreement between predicted values and values measured in laboratory tests, it appears possible to deduce in-situ soil strength parameters and their variation with depth from the results of static penetration tests. Author

N73-28446*# Stanford Univ., Calif. Radioscience Lab.
RECENT RESULTS FROM SATELLITE BEACON MEASUREMENTS
A. V. DaRosa Jun. 1973 42 p refs
(Grant NGR-05-020-001)
(NASA-CR-133475; TR-15; SU-SEL-73-022) Avail: NTIS HC $4.25 CSCL 03B

The techniques are reviewed for measuring ionospheric electron content, the most important parameter in the study of transionospheric propagation. Data collected since 1964 have yielded a synoptic description of the behavior of the electron content in midlatitudes. Empirical relationships between the level of solar activity and the electron content were developed permitting the prognostication of the electron content values. Construction of such prognostication schemes was stimulated by current efforts to create accurate satellite borne navigation systems. Gravity waves propagating in the thermosphere leave a signature in the electron content records. Studies of such records have allowed the identification of the position of the gravity wave source, and its radiation pattern. A one-to-one relationship between these waves and polar substorms was revealed. Electron content measurements were used to monitor the protonosphere with good time resolution. Protonospheric storms were observed with this technique. Slab thickness data obtained from content measurements were used to determine the neutral air temperature in the thermosphere. Author

N73-28447*# Stanford Univ., Calif. Radioscience Lab.
THE MIDLATITUDE IONOSPHERIC RESPONSE TO FLUCTUATIONS IN SOLAR ACTIVITY UNDER LOW GEOMAGNETIC ACTIVITY CONDITIONS
Jose Luis Bendito May 1973 111 p refs
(Grant NGR-05-020-001)
(NASA-CR-133474; SU-TR-16; SU-SEL-73-023) Avail: NTIS HC $7.75 CSCL 03B

The ionospheric response, which is the sensitivity and delay of the electron content to the 270 day fluctuations of solar radiation has been theoretically analyzed. In the context of the present work the sensitivity is defined as the magnitude of the electron content fluctuation for a given change in solar flux, and the delay is defined as the timeshift of the response of the electron content to fluctuations in solar flux. Both the model in which the action of neutral winds on the F-2 layer is disregarded and that in which the wind effect is included as part of a positive feedback mechanism, are studied. It is shown that the neutral winds play a dominant role in the mentioned ionospheric response. The computed delays decrease with increasing solar activity in both models. Author

N73-28448*# Colorado School of Mines, Golden. Dept. of Geology.
APPLICATION OF REMOTE SENSING TECHNIQUES TO THE GEOLOGY OF THE BONANZA VOLCANIC CENTER
Ronald W. Marrs Mar. 1973 297 p refs
(Grant NGL-06-001-015)
(NASA-CR-133499; Rept-73-1) Avail: NTIS HC $17.00 CSCL 08G

A program is reported for evaluating remote sensing as an aid to geologic mapping for the past four years. Data tested in this evaluation include color and color infrared photography, multiband photography, low sun-angle photography, thermal infrared scanner imagery, and side-looking airborne radar. The relative utility of color and color infrared photography was tested as it was used to refine geologic maps in previously mapped areas, as field photos while mapping in the field, and in making photogeologic maps prior to field mapping. The latter technique served as a test of the maximum utility of the photography. In this application the photography was used successfully to locate 75% of all faults in a portion of the geologically complex Bonanza volcanic center and to map and correctly identify 93% of all Quaternary deposits and 62% of all areas of Tertiary volcanic outcrop in the area. Author

N73-28449*# Boeing Commercial Airplane Co., Seattle, Wash.
RESEARCH STUDY ON ANTISKID BRAKING SYSTEMS FOR THE SPACE SHUTTLE
J. A. Auselmi, L. W. Weinberg, R. F. Yurczyk, and W. G. Nelson [1973] 226 p
(Contract NAS8-27864)
(NASA-CR-124349; D6-41115) Avail: NTIS HC $13.50 CSCL 22B

A research project to investigate antiskid braking systems for the space shuttle vehicle was conducted. System from the Concorde, Boeing 747, Boeing 737, and Lockheed L-1011 were investigated. The characteristics of the Boeing 737 system which caused it to be selected are described. Other subjects which were investigated are: (1) trade studies of brake control concepts, (2) redundancy requirements trade study, (3) laboratory evaluation of antiskid systems, and (4) space shuttle hardware criteria. Author

N73-28450# Plessey Co., Ltd., Havant (England).
MULTISPECTRAL SCANNING SYSTEMS AND THEIR POTENTIAL APPLICATION TO EARTH RESOURCE SURVEYS. VOLUME 4: EARTH SCIENCE APPLICATIONS
Apr. 1973 209 p refs
(Contract ESTEC-1673/72-EL)
(ERL/R-246; ESRO-CR(P)-234) Avail: NTIS HC $12.50

Research studies in agriculture, geography, geology, hydrology, and oceanography are presented, using multispectral scanning systems (MSS). Recommendations are given for European

programs. For individual titles, see N73-28451 through N73-28456.

N73-28451 Reading Univ. (England).
AN APPROACH TO THE EVALUATION OF MULTISPECTRAL SCANNING SYSTEMS c14
R. A. G. Savigear *In* Plessey Radar Res. Centre Multispectral Scanning Systems and their Potential Appl. to Earth Resource Surveys Apr. 1973 p 7-50 refs (For availability see N73-28450 19-13)

The data gathering potential of multispectral scanning (MSS) and the basic approach to the utilization of MSS data are discussed. The interdisciplinary aspects of MSS are considered, and its application to the fields of geology, hydrology, soil science, geomorphological analysis, and landscape mapping is described. An illustration of the necessity for regional integrated approaches is given using urban, mountain, desert, and oceanic environments as examples. ESRO

N73-28452 Reading Univ. (England).
THE APPLICATION OF MULTISPECTRAL SCANNING SYSTEMS TO AGRICULTURE AND FORESTRY
E. H. Roberts *In* Plessey Radar Res. Centre Multispectral Scanning Systems and their Appl. to Earth Resource Surveys Apr. 1973 p 51-84 refs (For availability see N73-28450 19-13)

The main research and development work in the field of multispectral scanning (MSS) of relevance to European agriculture is summarized. The reflectance characteristics of plants, soils, and vegetation are described, and the problems of crop identification and inventory are discussed. The assessment and monitoring of crop yield, vigor, damage, and disease are also discussed. The ground truth and data processing requirements are noted and MSS and other techniques are compared. ESRO

N73-28453 Imperial Coll. of Science and Technology, London (England).
THE APPLICATION OF MULTISPECTRAL SCANNING SYSTEMS TO GEOLOGY
J. W. Norman *In* Plessey Radar Res. Centre Multispectral Scanning Systems and their Potential Appl. to Earth Resources Surveys Apr. 1973 p 85-126 refs (For availability see N73-28450 19-13)

The physical characteristics of soils and rocks are briefly reviewed and the discipline requirements considered. The application of multispectral scanning (MSS) to various areas of geology, e.g. hydro-petroleum, engineering, geology, volcanology, and mineral exploration is discussed. The interpretation problems are broached and various methods described. Finally recommendations for instrument development and testing, interpreter training, and automatic data processing are made. ESRO

N73-28454 Institute of Hydrology, Wallingford (England).
THE APPLICATION OF MULTISPECTRAL SCANNING SYSTEMS TO HYDROLOGY
J. S. G. McCullock and R. B. Painter *In* Plessey Radar Res. Centre Multispectral Scanning Systems and their potential Appl. to Earth Resources Surveys Apr. 1973 p 127-149 refs (For availability see N73-28450 19-13)

Multispectral scanning (MSS) is applied to four areas of hydrology: landforms, soil moisture, water resources, and water depth and quality. Based on these studies, an experimental program is defined which would establish the feasibility of using MSS in pollution studies, measurement of soil moisture, suspended sediment, and location of freshwater springs. ESRO

N73-28455 Institute of Coastal Oceanography and Tides, Birkenhead (England).
THE APPLICATION OF MULTISPECTRAL SCANNING SYSTEMS TO OCEANOGRAPHY
D. A. Huntley *In* Plessey Radar Res. Center Multispectral Scanning Systems and their Potential Appl. to Earth Resource Surveys Apr. 1973 p 151-192 refs (For availability see N73-28450 19-13)

The optical properties of the sea and remote sensing techniques in oceanography are briefly reviewed. The problems and potential for multispectral scanning for sea surface temperature, coastal topography and water sediment load, marine biology and ecology, sea ice, and oil slicks are discussed. Suggestions are made for further study. ESRO

N73-28456 Plessey Co., Ltd., Havant (England).
[AIMS AND REQUIREMENTS OF FUTURE MULTISPECTRAL SCANNING PROGRAMS]
R. A. G. Savigear *In* Plessey Radar Res. Centre Multispectral Scanning Systems and their Potential Appl. to Earth Resources Surveys Apr. 1973 p 193-202 refs (For availability see N73-28450 19-13)

A coordinated approach is discussed to the way in which multispectral scanning might most usefully be implemented or used. The points considered are: aim of future programs, the methodological and technological requirements, the necessity for a flexible system, and the necessity for adequately surveyed and instrumented test areas. ESRO

N73-28457# Danish Space Research Inst., Lyngby.
SATELLITE EXPERIMENT FOR MEASURING LOW FREQUENCY WAVES IN THE SOLAR WIND AND MAGNETOSPHERE
A. Bahnsen, I. B. Iversen, H. Obayashi (Nagoya Univ., Japan), K. Omo, I. L. Rasmussen, and E. Ungstrup 1973 44 p refs (DSRI-73-01) Avail: NTIS HC $4.25

An instrument to measure electromagnetic radiation was flown on the HEOS-A2 satellite launched on January 31, 1972. The experiment is primarily aimed at measuring the electromagnetic noise outside the earth's bow shock. The method of measurement is described; the instrument consists of a loop antenna to measure magnetic fields, a double probe or dipole antenna to measure electric fields, and associated amplifiers, filters. Some preliminary data are presented. ESRO

N73-28458# Stockholm Univ. (Sweden). Dept. of Physical Geography.
THE APPLICATION OF PASSIVE MICROWAVE RADIOMETRY TO EARTH-RESOURCE SURVEYS
G. Hoppe, M. Falkenmark (Intern. Hydrol. Decade, Swed.), U. Karstroem (Meteorol. and Hydrol. Inst., Swed.), H. Svensson (Lund Univ.), and D. S. Parasnis (Uppsala Univ.) Paris ESRO Jun. 1972 108 p refs Prepared for SAAB-Scania AB, Linkoeping, Swed.
(Contract ESTEC-1411/71)
(ESRO-CR-75) HC $7.50

Passive microwave radiometry applied to the earth's surface is a discipline of remote sensing that makes use of the thermal energy emitted by objects at microwave wavelengths. Applications of microwave radiometry to the fields of agriculture (soils, vegetation, forests), geography (physical and human), hydrology, oceanography, and geology, are considered. It was concluded that microwave radiometry has great potential value in the fields of application studied and that substantial efforts in the investigation of various applications and in the development of the relevant technological methods is justified. It is recommended that high priority be given to compiling an inventory of earth resources and to monitoring environmental changes. It was also recommended that a development programm be undertaken to improve the performance of radiometric sensors available in Europe, that microwave radiometry be tested in comparison with other remote sensing techniques over selected sites with the aid of aircraft as a preparation for similar work with satellites, and that international cooperation be sought in this work since the problems encountered will undoubtedly be common to many geographical areas. Author

N73-28459# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA. DATA SUMMARY 73/1-3, JANUARY-MARCH 1973
G. Gustafsson, ed. Mar. 1973 68 p
Avail: NTIS HC $5.50

Data recorded at Kiruna relating to geomagnetic variations, auroras, cosmic noise, and ionospheric absorption are presented. Measurements include geomagnetic K-indices, all-sky camera records, and vertical incidence ionospheric soundings. Magnetograms, riometer recordings, and routine ionograms from the down station are reproduced. ESRO

N73-28460# Army Foreign Science and Technology Center, Charlottesville, Va.
GEOMETRICAL THEORY OF GRAVITATION AND ELECTRICITY
V. S. Brezhnev 29 Jan. 1973 30 p refs Transl. into ENGLISH from Problemy Teorii Gravitatsii i Elementarnykh Chastite (USSR), no. 3, 1970 p 75-102
(AD-761482; FSTC-HT-23-2315-72) Avail: NTIS CSCL 20/10

The physical interpretation of the tensor fields which are included in Einstein-Bonner's nonsymmetric field theory is given and the equations of motion of charged material particles are investigated. The physical interpretation allows a unique introduction of material sources into the field equations. Author (GRA)

N73-28461# Naval Postgraduate School, Monterey, Calif.
WAVE-RELATED VELOCITY FLUCTUATIONS OVER OCEAN WAVES AS MEASURED FROM FLIP (FLOATING INSTRUMENT PLATFORM) DURING BOMEX (BARBADOS OCEANOGRAPHIC METEOROLOGICAL EXPERIMENT) M.S. Thesis
David Robert Aurand Mar. 1973 72 p refs
(AD-761768) Avail: NTIS CSCL 04/1

Wave-related velocity fluctuations over ocean waves and wave heights as measured from FLIP (Floating Instrument Platform) during BOMEX (Barbados Oceanographic Meteorological Experiment) are examined using phase-amplitude results which are based on joint probability density function-conditional mean function analyses. Results are compared with predictions from various wind-wave coupling models. Results are examined in detail and consistent departures from theory are noted. An attempt is made to qualitatively determine the effect on specific results of the moving, but relatively stable, sensor platform, FLIP. It is concluded that the interaction between the wave-induced motion and airflow turbulence had a significant effect on the observed wave-related fluctuations. The effects of FLIP on the results appeared to be minimal on these results. Author (GRA)

N73-28462# Southern Methodist Univ., Dallas, Tex. Geophysical Lab.
CONTINENTAL RAYLEIGH WAVE DISPERSION AND THE ESTIMATION OF CHIRPFILTER DETECTORS
William Tucker, John A. McDonald, and Eugene Herrin Mar. 1973 47 p refs
(Grant AF-AFOSR-2133-71; ARPA Order 1827)
(AD-761795; AFOSR-73-1010TR) Avail: NTIS CSCL 08/11

Rayleigh wave data were recorded by a single vertical high-gain seismograph located in north Texas. It was found that Rayleigh waves propagating in a continental path over the pole to this station exhibited very stable dispersion characteristics, particularly in the period range 35-75 secs: at shorter periods an average dispersion curve could be estimated. A composite dispersion curve was used to develop chirp (or matched) filters, the form of which depended on the distance between the seismograph and the event. Such filters are shown to be very efficient in improving the signal-to-noise ratio of Rayleigh waves emanating from events in the Sino-Soviet region and can be used as a means of separating mixed Rayleigh waves. For the path over the pole (or 'polar waveguide') the detection threshold is estimated to be at mach 3.5. Author (GRA)

N73-28463# International Imaging Systems, Mountain View, Calif.
EXPERIMENTS IN OCEANOGRAPHIC AEROSPACE PHOTOGRAPHY. 2: IMAGE ACQUISITION AND ENHANCEMENT TECHNIQUES Final Report
D. S. Ross 28 Feb. 1973 109 p refs
(Contract N62306-71-C-0045)
(AD-761663; IS-TR-28-2-73) Avail: NTIS CSCL 08/10

The general objectives of the contract were to continue experimental work for the improvement of techniques in the photographic acquisition through the atmosphere of oceanographic image information, and its subsequent enhancement for data extraction by various photo-optical or other means. The work accomplished falls in two interrelated categories: Gross effects of the atmosphere on oceanographic imagery, and the enhancement of ocean images by photo-optical and electronic methods. GRA

N73-28464# Calspan Corp., Buffalo, N.Y.
A SEMI-AUTOMATIC SYSTEM FOR DIGITIZING BATHYMETRY CHARTS Final Report
R. B. Solosko 13 Jun. 1973 32 p
(Contract N00014-72-C-0466)
(AD-761647; VF-5206-X-1) Avail: NTIS CSCL 08/10

In support of the Long Range Acoustic Propagation Project (LRAPP), Office of Naval Research, Calspan Corporation has implemented a semi-automatic system for digitizing bathymetry charts. This system encodes the contour depth information in the following way. The bathymetry chart is overlayed by a set of parallel lines called track lines. The intersections of these track lines with the contour lines on the chart define the locations of points where the depth information is to be encoded. This bathymetry digitizing system will be used to digitize the 600 bathymetry charts which describe the undersea topography of the world. (Modified author abstract) GRA

N73-28465# Naval Underwater Systems Center, Newport, R.I.
ACOUSTIC VOLUME SCATTERING AT THE BERMUDA OCEAN ACRE SITE DURING SPRING AND SUMMER 1970 AND SUMMER 1971 (CRUISES 9, 10, AND 12)
Norbert P. Fisch and Robert K. Dullea 30 Apr. 1973 35 p refs
(AD-761976; NUSC-TR-4469) Avail: NTIS CSCL 17/1

Results of acoustic studies of the marine organisms of the sound scattering layers at the Bermuda Ocean Acre site are presented for the USNS SANDS: (T-AGOR-6) Cruises 9 and 10 in the spring and summer of 1970, respectively, and Cruise 12 in the late summer of 1971. On Cruises 9 and 10, reverberation was measured at 3.85, 13.5, and 15.5 kHz. On Cruise 12, frequency coverage was extended to include 1.3 and 5, 7, and 9 kHz. Upward-looking transducer-reflector systems operating at 1.3 and 3.85 kHz made it possible to survey in detail the upper 50 m of the water. This report presents the characteristics of the SSL in terms of scattering-strength-versus-depth profiles and integrated scattering strengths. Day-to-day variability and diurnal variations are considered and frequency dependence and seasonal effects are discussed. Author (GRA)

N73-28466# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
MISSILE-SITE GROUND COVER Final Report, Jan. - May 1970
James W. Carr Jun. 1973 40 p
(DA Proj. 1T0-62103-A-046)
(AD-762136; AEWES-Misc-Paper-S-73-35) Avail: NTIS CSCL 19/7

Experience with Army tactical rockets and missiles has shown that, during launchings over unprotected soil surfaces, the motor blast produces dust clouds that can reveal the firing location to the enemy and cause soil erosion in the launch area that is detrimental to reloading and operating conditions. Since the tactical missiles and rockets are highly mobile, the need exists for lightweight, flexible ground covers to enable rapid deployment and easy transporting. Tests were conducted at the U.S. Army Engineer Waterways Experiment Station (WES) in which small rocket motors were fired onto flexible, blast-resistant silicone rubber specimens at exposure temperatures of 3800F. The results of these tests were used to select the most suitable material for field testing. A prototype ground cover of the most promising materials was fabricated at WES. The ground cover consisted of silicone rubber applied to a woven glass fabric; the weight of this cover was 9 lb per sq yd. (Modified Author Abstract) GRA

N73-28467# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THULE RIOMETER OBSERVATIONS OF POLAR CAP ABSORPTION EVENTS (1962-1972)
Raymond J. Cormier 30 Jan. 1973 33 p refs
(AF Proj. 5631)
(AD-762279; AFCRL-TR-73-0060; AFCRL-AFSIG-255) Avail: NTIS CSCL 04/1

Polar Cap Absorption (PCA) events have been observed at Thule, Greenland, using a ground-based riometer for the past decade. The riometer was operated at a fixed frequency of 30 MHz, and used a two-element Yagi antenna directed toward

the zenith. This report provides information for operational systems personnel and systems designers concerning the mean behavior of PCAs and other aspects of the phenomenon; for example, the extreme cases in duration and magnitude. In addition, included as an appendix are plots of db absorption and proton flux (obtained from satellites) versus time for each event. The total number of events is 29. Author (GRA)

N73-28468# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
THE AFCRL EARTH TIDE PROGRAM Environmental Research Papers
Gerry H. Cabaniss and Donald H. Eckhardt 29 Jan. 1973 33 p
(AF Proj. 8607)
(AD-762275; AFCRL-TR-73-0084; AFCRL-ERP-433) Avail: NTIS CSCL 08/7

The operating instructions, as well as the mathematical and astronomical background, are given for a versatile computer code for calculating time series of earth tidal gravity and tilt. The contributions of ocean tidal loading can be simply incorporated if harmonic coefficients of the loading are available. The accuracy of the astronomical portion of the tide should be better than 1 percent. A number of output and printer-plotting options are easily exercised. The self-contained program was written for the CDC 6600 computer in FORTRAN Extended. Author (GRA)

N73-28469# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
RESULTS OF AEROLOGICAL OZONE SOUNDINGS AT THE HOHENPEISSENBERG METEOROLOGICAL OBSERVATORY Final Report, Jul. - Dec. 1972
Walter Attmannspacher Feb. 1973 143 p
(Contract DAJA37-71-C-3347)
(AD-762291) Avail: NTIS CSCL 04/1

Contents: Statistics of the ozone soundings, 1971; Code of tables of ozone sonde ascents; Ozone tables; Ozonagrams; Results of radio sonde measurements. GRA

N73-28470# White Sands Missile Range, N.Mex.
COMPARISONS OF RADAR REFRACTION CORRECTION COMPUTER PROGRAMS AT SELECTED TEST RANGES
1973 181 p refs
(AD-762383; RCC-113-70) Avail: NTIS CSCL 04/1

A detailed comparison of atmospheric refraction computer programs used at various National and Service Ranges has been made. This comparison shows that the data correction programs investigated give one order of magnitude better agreement when all are given the same refractive index profile than they do when they are allowed to use that surface value to determine the profile by their own internal methods. A profile with a strong super-refractive layer was also used in comparing the programs. Widely differing refractive bending effects, is less than 10 feet. The report shows that the numerical methods of the various refraction correction programs produce similar results with similar input data. It also shows that care should be exercised to assure that data taken at one range and processed at another is refraction corrected with atmospheric data for the range at which the data was taken. Numerical methods of refraction correction are similar at the various ranges but local atmospheres are not. Author (GRA)

N73-28471# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
GOOSE IONOSPHERIC OBSERVATORY: PHOTOMETRIC MEASUREMENTS PROGRAM REPORT OF FIRST YEAR OPERATIONS Final Report
Robert D. Sears 27 Nov. 1972 18 p refs
(Contract DASA01-71-C-0158)
(AD-762081; DNA-3033F) Avail: NTIS CSCL 04/1

A three color, digitized photometer was installed at the Goose Ionospheric Observatory in Oct. 1971 to support and complement the AFCRL radio propagation experiments. The goals of the photometric observing program are twofold: To supply data on airglow and auroral intensity to the radio experiments and to detect and measure the characteristics of high latitude wavelike disturbances in the ionosphere as evidenced by airglow and auroral emission intensity variations. The first year's experimental effort, devoted principally to apparatus shake down, exploratory measurements at zenith, and preparation and verification of the data reduction and analytical programs required is described. Author (GRA)

N73-28472# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATMOSPHERIC STRUCTURE WHITE SANDS MISSILE RANGE, NEW MEXICO. PART 3: UPPER AIR AND SURFACE DATA, JALLEN SITE
Marjorie McLardie Hoidale, Raymond L. Russo, and Lamar Newman May 1973 246 p refs Revised
(DA Proj. 1T5-56702-D-127)
(AD-762159; DR-776) Avail: NTIS CSCL 04/2

A statistical analysis of surface and upper air rawinsonde data is presented for Jallen Site, White Sands Missile Range, New Mexico. Atmospheric parameters covered for the layer from the surface to 100,000 feet above mean sea level are: wind, temperature, pressure, density, moisture, index of refraction and freezing level. Upper air climatological information is based on the period of observation from 1962-1971; while the surface data, in general, spans 1963-1972. Author (GRA)

N73-28473# Texas Instruments, Inc., Dallas. Services Group.
LONG TERM BROAD BAND VERTICAL EARTH NOISE STRUCTURE AT VERY LONG PERIOD EXPERIMENT SITES Special Report
Stephen A. Alsup and Ervin S. Becker 21 Feb. 1973 51 p refs
(Contract F33657-72-C-0725; ARPA Order 1714)
(AD-761812; TI-SR-3) Avail: NTIS CSCL 17/10

A series of one-hour samples of seismic noise have been taken from vertical instrument channel recordings at the Very Long Period Experiment (VLPE) sites for evaluation of the long-term broad-band earth noise field in the VLPE network. Converted power spectral density estimates of the root-mean-square noise amplitudes in the samples were corrected for channel response characteristics and then examined for long term trends and both broad and narrow band variability. Correlation of intraband noise variability is discussed. (Modified Author Abstract) GRA

N73-28474# Stanford Research Inst., Menlo Park, Calif.
AURORAL CLUTTER MAPPING WITH THE HOMER, ALASKA BACKSCATTER RADAR
C. K. Hinricks Jun. 1973 35 p refs
(Contract DNA001-72-C-0143; DNA Proj. NWET-L25AAXY; SRI Proj. EGU-1928)
(AD-762012; SRI-EGU-TN-1928-A4; DNA-3074T) Avail: NTIS CSCL 04/1

The High Altitude Effects Simulation (HAES) program is an effort to indirectly obtain information on the reaction of the upper atmosphere to nuclear explosions. This technical note is one of a series that provides brief descriptions of scientific programs investigating the physics and chemistry of the upper atmosphere under normal and disturbed conditions. The Homer radar has been developed over a number of years into a highly flexible multifrequency system to detect and measure specifically the radar reflections (clutter) from the various kinds of ionization inhomogeneities produced by atmospheric nuclear explosions. This radar has also proved to be a valuable tool in the investigations of auroral radar returns with a view to understanding the complex mechanisms producing auroral clutter. A description of the radar and auroral clutter mapping is given. (Modified Author Abstract) GRA

N73-28475# Stanford Research Inst., Menlo Park, Calif.
MEASUREMENTS OF AURORAL INFRARED EMISSIONS WITH A HIGH RESOLUTION INTERFEROMETER SPECTROMETER (HIRIS)
C. K. Hinrichs Jun. 1973 23 p refs
(Contract DNA001-72-C-0143)
(AD-762013; SRI-EGU-TN-1928-A2; DNA-3075T) Avail: NTIS CSCL 04/1

The High Altitude Effects Simulation (HAES) program is an effort to indirectly obtain information on the reaction of the upper atmosphere to nuclear explosions. In the absence of actual nuclear testing in the atmosphere, a number of experiments

are being carried out both in the laboratory and in the field to determine a sufficient number of parameters to characterize the environment and its reactions in a suitable model. This technical note is one of a series that provides brief descriptions of scientific programs investigating the physics and chemistry of the upper atmosphere under normal and disturbed conditions. One of these experiments uses a rocket-borne High Resolution Interferometer Spectrometer (HIRIS) to measure auroral emissions in the far infrared region of the electromagnetic spectrum. This spectrometer is the principal rocket payload to be flown from the Poker Flat, Alaska rocket range in the ICECAP 73 series during February-March 1973. The data obtained will be correlated with ground-based radar, optical, and magnetic measurements, and with rocket-borne measurements of atmospheric density, wind, and precipitating energetic particle fluxes. A description of the spectrometer and the experiment is given. Author (GRA)

N73-28476# Naval Oceanographic Office, Washington, D.C.
SYNTHETIC BATHYMETRIC PROFILING SYSTEM (SYNBAPS)
Roger J. VanWyckhouse May 1973 147 p refs
(AD-762070; NOO-TR-233) Avail: NTIS CSCL 08/10

The Synthetic Bathymetric Profiling System (SYNBAPS) consists of 10 FORTRAN 4 computer programs, a random-access storage device, and an initial bathymetric data base of over 3 million data points. SYNBAPS is designed for rapid generation of random omnidirectional bathymetric profiles in digital form along great-circle paths. The initial data base will cover most of the Northern Hemisphere and will be extended to other regions as suitable bathymetric contour charts become available. SYNBAPS will provide bathymetric profiles at about one-fifth the cost and one-hundredth the time of present semiautomated methods. (Modified Author Abstract) GRA

N73-28477# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS FOR THE CALCULATION OF LONG-WAVE RADIATION FLUXES IN THE ATMOSPHERE WITH THE HELP OF ELECTRONIC COMPUTERS
V. F. Zhvalev 1 May 1973 23 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 203, 1967 p 49-57
(AD-761579; FTD-MT-24-1858-72) Avail: NTIS CSCL 04/1

A brief survey is given on the procedure for calculating the integral and spectral flux of long-wave radiation with the help of electronic computers. GRA

N73-28478# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
PROJECT EXCEDE: SWIR (SHORT WAVE INFRARED) EXPERIMENT
R. R. Oneil, E. T. P. Lee, E. R. Huppi, and A. T. Stair, Jr. 5 Mar. 1973 41 p refs
(AD-762206; AFCRL-TR-73-0152; AFCRL-ERP-437) Avail: NTIS CSCL 04/1

Project EXCEDE SWIR (Short Wave Infrared) consists of an electron accelerator and a number of optical and infrared sensors launched by a single rocket into an undisturbed (nonauroral) night atmosphere. The accelerator and sensors are oriented in a prescribed manner at approximately 100 to 110 km, and the electron source activated for a given beam-current-pulse magnitude and duration. The spectral, spatial and temporal nature of ultraviolet, visible and primarily infrared atmospheric emissions are measured by onboard sensors. Ground based instruments photographically record the spatial distribution of electron energy deposition in the atmosphere by imaging N2(-) first negative 3914A (0-0) emission. EXCEDE SWIR is designed to provide measurable NO emission at 2.7 and 5.4 micrometers and NO(-) emission at 2.2 and 4.3 micrometers to determine principal production mechanisms, reaction rates and infrared photon yields for electron-induced atmospheric processes at 100 to 110 km. (Modified Author Abstract) GRA

N73-28479# Utah State Univ., Logan. Electro-Dynamics Lab.
INFRARED EMISSION FROM ELECTRON IRRADIATED AIR LABORATORY EXPERIMENT FEASIBILITY STUDY Special Scientific Report No. 2
Morton Camac Nov. 1972 62 p refs Prepared in cooperation with Aerodyne Res., Inc.
(Contract F19628-70-C-0289; ARPA Order 1366; AF Proj. 8692)
(AD-762318; ARI-RR-1; AFCRL-TR-73-0198) Avail: NTIS CSCL 04/1

A laboratory measurements program to simulate many chemical and radiative processes present at auroral altitudes is evaluated. An electron beam would be used to irradiate O2 - N2 mixtures, either pure or with O3, NO, CO2, or H2O additives and measurements then made of the resultant ultraviolet, visible, and infrared emissions from the gas. The spatial distribution of the electron beam energy deposition would be obtained from the N2(1-) emission. The concentrations of metastable species would be determined from their emission. A major objective would be the investigation of infrared emission from air irradiated by ionizing radiation. Estimates of the infrared emission from NO, O3, NO2 are presented as a function of pressure and electron beam current. The degree of ionization of the gas is low due to rapid dissociative recombination. The operating range of the experiment is also investigated. The low pressure limit has been determined by diffusion losses to the wall. The high pressure limit was set by three-body reactions at low beam power and by thermal convection losses at high power. (Modified Author Abstract) GRA

N73-28480# Utah State Univ., Logan. Electro Dynamics Lab.
EVALUATION OF CO RELEASES TO DETERMINE ATMOSPHERIC N2 VIBRATIONAL POPULATION Special Scientific Report
Morton Camac Apr. 1973 36 p refs Prepared in cooperation with Aerodyne Res., Inc.
(Contract F19628-70-C-0289; ARPA Order 1366; AF Proj. 8692)
(AD-762316; ARI-RR-10; AFCRL-72-0708) Avail: NTIS CSCL 04/1

The paper evaluates the use of gaseous CO releases at high altitudes to determine the atmospheric N2 vibrational temperature. Since vibrational energy transfer from N2 to CO leads to CO infrared emission in the 4.7-micron fundamental band and 2.4-micron overtone band, CO infrared intensity measurements might be used to obtain the vibrational temperature. One result of these predictions is that CO emission intensity in the 2.4-micron band will be low due to radiation cooling of the first CO vibration level. Excitation of the second level is predominantly by the weaker single-step process involving a two-vibration quantum transfer from N2 to CO. The slow rate for the two-quantum transfer process makes observation of the overtone radiation emission difficult. Emission in the 4.7-micron band is not affected by radiation cooling. However, for a ground-based platform, 4.7-micron radiation is severely attenuated by the atmosphere. This experiment would be severely limited by additional CO emission that is excited by other sources, particularly sun and earthshine. (Modified Author Abstract) GRA

N73-28481# Stanford Research Inst., Menlo Park, Calif.
ENERGY TRANSFER REACTIONS INVOLVING METASTABLE SPECIES OF ATMOSPHERIC INTEREST Final Report
Graham Black 11 May 1973 19 p refs
(Contract DAHC04-70-C-0034; AROD Proj. P-8279-C; SRI Proj. PYU-8584)
(AD-762201) Avail: NTIS CSCL 04/1

Energy transfer reactions of electronically excited atomic and diatomic species were studied. The excited species were created by vacuum ultraviolet irradiation of simple molecules, with image-tube spectrographs and filtered photomultipliers being utilized to detect and monitor emission features. A pulsed photolysis-signal integration system was used to determine absolute rate coefficients for energy transfer reactions of O(singlet S), N2(A triplet Sigma(u)(-)), and N(doublet D). The variations of these rate coefficients with temperature were determined for application of quenching rate coefficients to various regions of the earth's atmosphere. One such application was to time-lag measurements of O(singlet S) emission in Type-B red aurora; O(singlet D) and CO(a triplet pi) were also studied. (Modified Author Abstract) GRA

N73-28482# Research Triangle Inst., Durham, N.C.
A PRELIMINARY STUDY OF THE TRANSIENT RESPONSE OF THE ATMOSPHERE PRODUCED BY MID-TROPOSPHERIC HEATING Final Report, 12 Nov. 1971 - 11 Feb. 1973
Fred M. Vukovich May 1973 43 p refs
(Contract DAHC04-72-C-0010)
(AD-762369; AROD-9933-1-EN) Avail: NTIS CSCL 04/1

A simple linear model is developed to study the transient response of the atmosphere, a system of internal gravity waves, due to midtropospheric heating. The effects of varying stability, mean wind, the horizontal and the vertical distribution of the heating, and the rate at which heat is added are presented. It was found that under certain conditions specifically related to the vertical thickness of the layer heated and the stability of the air, the vertical velocities in the upper and lower atmosphere attain magnitudes in excess of three meters per second. The magnitude of the vertical velocities will increase further if the rate at which heat is added is increased. Decreasing the horizontal dimensions of the region where heat is added does not change the magnitude of the vertical velocities appreciably except for the gravity wave with the largest vertical wavelength; however, the horizontal scale of the gravity wave systems is smaller and wave speeds are less since they are proportional to horizontal wavelength. Author (GRA)

N73-28483# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
HIGH LATITUDE MODELS, OBSERVATIONS, AND ANALYSIS OF IONOSPHERIC SCINTILLATIONS
Jules Aarons, Herbert E. Whitney, Richard S. Allen, and Douglas Seemann, R. 12 Jan. 1973 66 p refs
(AF Proj. 4643)
(AD-762282; AFCRL-AFSIG-254; AFCRL-TR-73-0048) Avail: NTIS CSCL 04/1

In order to provide systems engineers with observations and analysis of the amplitude-fading of radio waves traversing the high latitude ionosphere, several different studies were performed. The concept was to develop descriptive and statistical models for the pattern of occurrence and amplitude of scintillations at high latitudes. Then, long term observations from a limited number of sites could be linked to allow an assessment of the scintillation problem to communication, navigation, and detection systems in the VHF and UHF bands. Then, long terms observations from a limited number of sites could be linked to allow an assessment of the scintillation problem to communication, navigation, and detection systems in the VHF and UHF bands. This report discusses these studies in three chapters. In Chapter 1, general patterns of scintillation occurrence and intensity are presented in the descriptive model of the F-layer irregularities at high latitudes. This is followed in Chapter 2 by a graphical presentation of the data; that is, observations of the 136 MHz beacon of ATS-3. Chapter 3 organizes the observations into a useful format-the cumulative amplitude probability distribution function-for the engineer. A means of adjusting the observations for frequency dependence is provided. (Modified Author Abstract) GRA

N73-28484# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ANALOG MODEL 1972 OF THE ARCTIC IONOSPHERE
G. L. Gassmann 2 Mar. 1973 30 p refs
(AF Proj. 5631)
(AD-762280; AFCRL-AFSIG-259; AFCRL-TR-73-0151) Avail: NTIS CSCL 04/1

The report supplements earlier attempts at modelling. Its elements are the result of a group effort, which is continuing. The arctic ionosphere and its dynamics are described as a fairly self-consistent empirical quasi-instantaneous model, adaptable to later improvements. The definitions are in analog form using model, adaptable to later improvements. The definitions are in analog form using tables, graphs, and analytical formulas. The model parameters controlling the arctic ionosphere are substorm time and intensity and oval number Q. Emphasis is given as to how those parameters may be obtained in near-real-time. For this purpose, two superimposed coordinate systems and two reference latitudes are introduced. The model assumes absence of sunlight; it provides rules for adding the sunlit contribution and for matching the arctic model to the moderate-latitude ionosphere. Author (GRA)

N73-28485# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany).
ATMOSPHERIC AEROSOLS BETWEEN 700 AND 3000 M ABOVE SEA LEVEL. PART 6: PARAMETERIZATION OF AEROSOL EDDY DIFFUSION CONTROLLED BY AEROLOGICAL PARAMETERS Final Technical Report
Reinhold Reiter, Rudolf Sladkovic, and Walter Carnuth Feb. 1973 130 p refs
(Contract DAJA37-70-C-2647; DA Proj. 1T0-61102-B-53A)
(AD-762335) Avail: NTIS CSCL 04/1

Studies are reported for the effects of aerological fine-structure characteristics upon vertical distribution of aerosols. Emphasis largely on concluding the development of a parameterization of the relationship between aerological parameters and vertical eddy aerosol diffusion. This parameterization is based (a) on a recently improved theoretical derivation of exchange coefficient from vertical profiles of particle concentration; (b) on the entirety of data obtained in several years; and thus (c) on adequate statistical significance. GRA

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N73-28486* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPARATUS AND METHOD FOR MEASURING THE SEEBECK COEFFICIENT AND RESISTIVITY OF MATERIALS Patent
Vaclav Hadek, inventor (to NASA) Issued 5 Jun. 1973 5 p Filed 26 Aug. 1971 Supersedes N72-20398 (10 - 11, p 1473) Sponsored by NASA
(NASA-Case-NPO-11749; US-Patent-3,737,762;
US-Patent-Appl-SN-175267; US-Patent-Class-324-52;
US-Patent-Class-73-15R) Avail: US Patent Office CSCL 14B

An apparatus for measuring the thermoelectric properties of materials under high pressure is described that includes a pair of force transmitting assemblies constructed of thermally and electrically conductive material positioned between the ram and anvil of a press. Each force transmitting assembly has a small diameter pressing portion for contacting a face of the sample so that the sample can be squeezed between them. Each assembly also includes a heat exchanger to maintain the sample face at a controlled temperature, and an electrical conductor to carry current generated by the sample. A sleeve of thermally and electrically insulative material closely surrounds the pressing portions of the two assemblies.
Official Gazette of the U.S. Patent Office

N73-28487* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURIZED PANEL Patent
Erskine C. White, inventor (to NASA) Issued 10 Jul. 1973 4 p Filed 6 Nov. 1970 Continuation-in-part of US Patent Appl. SN-777765, filed 21 Nov. 1968
(NASA-Case-XLA-08916-2; US-Patent-3,744,320;
US-Patent-Appl-SN-97472; US-Patent-Class-73-432R;
US-Patent-Class-73-170R; US-Patent-Appl-SN-777765) Avail: US Patent Office CSCL 14B

Large area pressurized meteoroid penetration detector panels with maximum inherent structural rigidity are provided. The panels measure directly the penetration rate in materials to be used in spacecraft. Panel structure include an interconnected cellular configuration in which the cells have spaced periphery welds and tufts in their centers. A spot weld is made at the center point joining the panels.
Official Gazette of the U.S. Patent Office

N73-28488* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD AND APPARATUS FOR MEASURING ELECTROMAGNETIC RADIATION Patent
Julian F. Been, inventor (to NASA) Issued 10 Jul. 1973 4 p Filed 6 Jan. 1971 Supersedes N71-31127 (09 - 18, p 2924)
(NASA-Case-LEW-11159-1; US-Patent-3,745,357; US-Patent-Appl-SN-104346; US-Patent-Class-250-336; US-Patent-Class-307-308) Avail: US Patent Office CSCL 14B

An apparatus and method are described in which the capacitance of a semiconductor junction subjected to an electromagnetic radiation field is utilized to indicate the intensity or strength of the radiation.
Official Gazette of the U.S. Patent Office

N73-28489* Electronic Image Systems Corp., Cambridge, Mass.
DRYING APPARATUS FOR PHOTOGRAPHIC SHEET MATERIAL Patent
Paul Epstein, George Donovan, and Eric LaWhite, inventors (to NASA) Issued 10 Jul. 1973 7 p Filed 12 Nov. 1971 Supersedes N72-20391 (10 - 11, p 1472) Sponsored by NASA
(NASA-Case-GSC-11074-1; US-Patent-3,744,148; US-Patent-Appl-SN-198362; US-Patent-Class-34-160; US-Patent-Class-34-155; US-Patent-Class-34-162) Avail: US Patent Office CSCL 14E

An elongated drying chamber is provided with transport means for carrying photographic sheet material edgewise with the sheets in end-to-end relationship past a plurality of tubes that issue drying air streams. The tubes are slotted a distance equal to substantially the full width of the sheet material for complete, gentle drying by sheets of air. A common plenum supplies the tubes with heated air; the air is directed from the tube slots at a pronounced angle to the sheet surface to provide for arraying the tubes close to the surface for maximum drying effect while minimizing the danger of mechanical interference between the edges of the sheets and the slots in the tubes. The driver for the transport is housed in an enclosure between the plenum and the drying chamber; an air return duct is provided along another side to complete insulation of the drying chamber from ambient conditions. Official Gazette of the U.S. Patent Office

N73-28490* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVICE FOR DETERMINING RELATIVE ANGULAR POSITION BETWEEN A SPACECRAFT AND A RADIATION EMITTING CELESTIAL BODY Patent
Winfield H. Farthing and Herbert F. Frisbie, inventors (to NASA) Issued 10 Jul. 1973 9 p Filed 24 Feb. 1972 Supersedes N72-21418 (10 - 12, p 1608)
(NASA-Case-GSC-11444-1; US-Patent-3,744,913; US-Patent-Appl-SN-229128; US-Patent-Class-356-141; US-Patent-Class-250-214R; US-Patent-Class-250-209; US-Patent-Class-250-203R) Avail: US Patent Office CSCL 14B

Signals indicative of the relative angular position between a spin stabilized spacecraft, probe, or sounding rocket and a radiation emitting celestial body are derived with a detector including four electrodes for deriving indications of the centroid of the radiation image on the detector. During each spin of the satellite each electrode derives a signal having a first non-zero level while the detector is not illuminated by the radiation, and a sound non-zero level while it is illuminated by the radiation.
Official Gazette of the U.S. Patent Office

N73-28491* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL PURPOSE OPTICAL INSTRUMENT CAPABLE OF SIMULTANEOUSLY ACTING AS SPECTROMETER AND DIFFRACTOMETER Patent
Kamalaksha DasGupta, Herbert W. Schnopper, and Albert E. Metzger, inventors (to NASA) Issued 22 Apr. 1969 5 p Filed 3 Feb. 1966 Sponsored by NASA
(NASA-Case-XNP-05231; US-Patent-3,440,419; US-Patent-Appl-SN-524746; US-Patent-Class-250-51.5) Avail: US Patent Office CSCL 14B

A dual purpose optical instrument is described capable of simultaneously acting as a spectrometer and diffractometer to respectively perform elemental and structural analysis of an unknown sample. The diffractometer portion of the instrument employs a modified form of Seeman-Bohlin focusing which involves providing a line source of X-rays, a sample, and a detector, all on the same focal circle. The spectrometer portion of the instrument employs a fixedly mounted X-ray energy detector mounted outside of the plane of the focal circle.
Offical Gazette of the U.S. Patent Office

N73-28492 Maryland Univ., College Park.
A POLARIZATION FOURIER SPECTROMETER: DESIGN, CONSTRUCTION, AND ASTRONOMICAL OBSERVATIONS Ph.D. Thesis
Franics Joseph Ahern 1972 146 p
Avail: Univ. Microfilms Order No. 73-9669

The design, construction, and operation of a polarization Fourier spectrometer are discussed. The instrument is used for astronomical applications and covers a spectral range of 3300 Angstroms to 2.5 microns without overlapping orders. The instrument determines the spectrum simultaneously in two orthogonal planes of linear polarization. The instrument is designed to be insensitive to the sky background and to slight transparency changes as caused by thin clouds. Results of performance tests are provided. Dissert. Abstr.

N73-28493*# ITT Gilfillan, Inc., Van Nuys, Calif.
MULTI MODE OPTICAL SENSOR MMOS Final Report
Jun. 1973 215 p
(Contract NAS9-11934)
(NASA-CR-133980; Rept-6906) Avail: NTIS HC $12.75 CSCL 14B

The development of a multimode optical sensor (MMOS) is reported. The objectives, accomplishments, and history of the program are presented along with a description of the MMOS. A collection of design studies, tradeoff studies, and test results are included. F.O.S.

N73-28494*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LST PHASE A DESIGN UPDATE STUDY
1 Aug. 1973 182 p refs
(NASA-TM-X-64763) Avail: NTIS HC $11.25 CSCL 14B

An update is presented of the Phase A study of the Large Space Telescope (LST), based on changes in guidelines and new data developed subsequent to the Phase A study. The study defines an LST concept based on the broad mission guidelines provided by the Office of Space Science (OSS), the scientific requirements developed by OSS with the scientific community, and an understanding of long range NASA planning current at the time the study was performed. A low cost design approach was followed. This resulted in the use of standard spacecraft hardware, the provision for maintenance at the black box level, growth potential in systems designs, and sharing of shuttle maintenance flights with other payloads (See N73-18449 through N73-18453) Author

N73-28495*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STRAIN GAGE MOUNTING ASSEMBLY Patent Application
Robert H. Silver and Sarkis H. Kalfayan, inventors (to NASA) Filed 24 Jul. 1973 15 p
(Contract NAS7-100)
(NASA-Case-NPO-13170-1; US-Patent-Appl-SN-382261) Avail: NTIS HC $3.00 CSCL 14B

A mounting assembly which can amplify the measurable strain deformation applied to a strain gage is described. The construction and operation of the equipment are described. The mounting assembly is of particular value in monitoring the internal pressure of corrosion resistant containers such as glass. The technique permits monitoring objects where small deformations could lead to failure in order to prevent excessive stress. P.N.F.

N73-28496*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SPECTROMETER INTEGRATED WITH A FACSIMILE

CAMERA Patent Application
Ernest E. Burcher, Daniel J. Tobson, Stephen J. Katzberg, and William L. Kelly, IV, inventors (to NASA) Filed 2 Aug. 1973 12 p
(NASA-Case-LAR-11207-1; US-Patent-Appl-SN-385013) Avail: NTIS HC $3.00 CSCL 14B

Spectrometer capability is integrated with the basic imagery function of facsimile cameras without significantly increasing mechanical or optical complexity, or interfering with the imaging function. The system consists of a group of photodetectors arranged in a linear array in the focal plane of the facsimile camera with a separate, narrow band interference filter centered over each photodetector. The interference filter photodetector array is on a line in the focal plane of the facsimile camera along the direction of image motion due to the rotation of the facsimile camera's vertical mirror. As the image of the picture element of interest travels down the interference filter photodetector array, the photodetector outputs are synchronously selected and sampled to provide spectral information on the single picture element. The selection of the proper photodetector and data sampling is controlled by information derived from the servo system controlling the vertical mirror rotation. NASA

N73-28497*# Wisconsin Univ., Madison.
COAXIAL ANODE WIRE FOR GAS RADIATION COUNTERS Patent Application
William L. Kraushaar, inventor (to NASA) Filed 21 Jun. 1973 17 p Sponsored by NASA
(NASA-Case-GSC-11492-1; US-Patent-Appl-SN-372148) Avail: NTIS HC $3.00 CSCL 14B

A coaxial anode for a gas radiation counter is described which suppresses undersirable background ionization interference. The anode is comprised of an elongated central wire covered with an electrically insulating sleeve, and longitudinally discontinuous segments of an electrically conductive coating around the insulating sleeve along the length of the central wire. The conductive segments define a veto or rejection anode at each end of the central wire, and a charge detection anode between the rejection anodes. The charge detecting anode is connected to detection circuitry in anti-coincidence with the rejection anodes. Background radiation detected by either of the rejection anodes and the charge detecting anode is rejected, thereby increasing the sensitivity of the radiation counter. NASA

N73-28498*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF THE GEOMETRICAL FACTOR AND OF THE SPATIAL DISTRIBUTIONS OF PARTICLES FOR A COSMIC RAY TELESCOPE USING A MONTE CARLO APPROACH
Michael Hemmer and Carol Jo Crannell Jul. 1973 44 p refs Prepared in cooperation with Federal City Coll.
(Grant NGR-09-050-001)
(NASA-TM-X-70428; X-661-73-218) Avail: NTIS HC $4.25 CSCL 14B

A program is presented which uses a Monte Carlo technique to compute the geometrical factor of a detector, and the spatial and angular distributions of simulated particles at designated layers within the detector. As the program is written, each layer is assumed to be rectangular, parallel to every other layer with its edges parallel to the edges of every other layer, and centered about a common axis. This program is written in Fortran 4 for the IBM 360 computers and is currently being run under the Fortran 4 (h) compiler. Same features such as the subroutine ERRSET, RANDU, and REMTIM and the type declarations REAL *8 and LOGICAL *1 may need to be changed for use with a different computer system. The use of input data cards, and a sample data set are presented. Lists of the symbol definition, card images of the FORTRAN object deck and subroutines are included along with a flow diagram. Author

N73-28499*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROSCOPE MULTI-ANGLE, REFLECTION, VIEWING ADAPTOR AND PHOTOGRAPHIC RECORDING SYSTEM Patent Application
Aaron Fisher and Carroll H. Clatterbuck, inventors (to NASA) Filed 16 Jul. 1973 11 p
(NASA-Case-GSC-11690-1; US-Patent-Appl-SN-379290) Avail: NTIS HC $3.00 CSCL 14E

A device is described for displaying and recording angled views of a sample to be viewed by a microscope. A multiangled mirror microscope adaptor, a microscope and a camera positioned for viewing and photographically recording the sample are included. NASA

N73-28500*# TRW Systems Group, Redondo Beach, Calif.
DEVELOPMENT OF ISOTHERMAL RIGS Final Report
R. A. Kaminskas and D. J. Malone 9 Apr. 1973 49 p ref (Contract NAS8-28574)
(NASA-CR-124314) Avail: NTIS HC $4.50 CSCL 14B

The results of the Resonant Infrasonic Gauging System (RIGS) development program are reported. The RIGS is a gauging system that is capable of measuring propellant quantity under zero-G as well as under accelerated (one-G) conditions. With the exception of liquid hydrogen, it can be used to gauge virtually any propellant in liquid form including cryogenics. The gauge consists of a sensor unit which is attached to the propellant tank and electronic control unit which may be positioned separately from the sensor. The control unit receives the signals from the sensor as well as the ullage gas pressure and propellant temperature measurements, and computes the propellant quantity remaining in the tank. During the course of this program two prototype RIGS sensors were designed and constructed. The sensors were tested first in the laboratory using water as the simulated propellant and, later, using LN2 in a 100-gallon tank. The system tests proved that the gauge operates virtually as predicted by theory and yielded an accuracy better than 1%. Author

N73-28501# European Space Research Inst., Frascati (Italy).
IMPROVEMENTS OF THE PROPERTIES OF THE RELATIVISTIC PARALLEL PLATE PARTICLE ANALYZER
Georges A. Proca 1973 23 p refs Submitted for publication
Avail: NTIS HC $3.25

Using a three-dimensional formalism, the freedom to choose the coupling function g(theta, phi) between the polar angles defining the mean trajectory in the field free region of the analyzer is exploited to improve on the properties of the instrument. It is shown that a partial correction to the z variation of the image when theta and phi vary can be achieved yielding a maximum excursion delta z/z of 6 percent for a total theta excursion of delta theta 18 deg at phi = const with a corresponding increase of resolving power by a factor of 2. Indications are also given on the possibility of cylindrization of the focal surface.
Author (ESRO)

N73-28502# Osservatorio Astronomico, Rome (Italy).
ON THE ACCURACY OF THE SPECTROPHOTOMETRY WITH KODAK IN, IIaO AND IIaD EMULSIONS
A. Cassatella and R. Viotti (Lab. di Astrofis. Spaziale, Frascati, Italy) Nov. 1972 16 p refs
(RR-3) Avail: NTIS HC $3.00

The characteristics of three different types of emulsions used for high dispersion and objective prism spectrophotometry are investigated. The influence of the contrast variations, nonuniformity of the spectrograms, and hypersensitization on measurement accuracy are found and shown. Author (ESRO)

N73-28503# Officine Galileo S.p.A., Florence (Italy).
DESIGN STUDY OF AN INFRARED SENSOR BASED ON NON-THERMOVOLTAIC DETECTORS FOR ACCURATE EARTH POINTING OF A GEOSTATIONARY SATELLITE Final Report
R. Baldassini Fontana, L. Ballerini, G. deVidi, S. Pieri, and I. Varano Paris ESRO Jan. 1973 263 p
(Contract ESTEC-1400/71)
(ESRO-CR-161) Avail: NTIS HC $15.25

A design study was conducted to develop an infrared earth-horizon sensor capable of providing information on pitch-and roll-axis positions with respect to the local vertical, with an accuracy at null of 0.05 deg (3 sigma) from a nominally circular, geosynchronous orbit. The investigation was restricted to sensors employing pyroelectric and thermistor bolometer detectors. The first part of the study analyzes and compares various sensor concepts, such as static horizon sensors, edge trackers, and scanners. The second part consists of a detailed study of the

preferred concept, which is a sensor operating on the signals coming from four thermistor bolometers whose fields of view are scanned through the earth-disc boundary by an oscillating mirror. The mirror scan amplitude is measured via an optical incremental encoder. The optimisation of the optical, mechanical and processing electronic parameters is reported and discussed. The error budget shows that the proposed sensor will meet the accuracy requirement. Author (ESRO)

N73-28504# Interuniversitair Reactor Instituut, Delft Netherlands).
DESIGN OF THE ELECTRICAL CIRCUITRY FOR A POSITION SENSITIVE HIGH RESISTANT ANODE WIRE He3 NEUTRON DETECTOR
Ozer Ciftcioglu May 1973 43 p
(IRI-132-73-02) Avail: NTIS HC $4.25

Electrical analysis of the position sensitive detector system was carried out. The system contains a radiation detector, an electronic circuitry for the pulses obtained from the detector, and a coupling system between the detector and the circuitry. Numerical calculations were based on a GM tube already available at the institute. In Addition, two systems for position indentification are described, namely, the voltage source position sensitive detector system and the current source position sensitive detector. Author (ESRO)

N73-28505# Panametrics, Inc., Waltham, Mass.
A PROTON-ALPHA PARTICLE DETECTOR FOR USE IN SATELLITE Final Report, 12 Nov. 1970 - 28 Feb. 1973
Frederick A. Hanser, Bach Sellers, and Paul R. Morel Feb. 1973 95 p refs
(Contract F19628-71-C-0109; AF Proj. 8600)
(AD-760147; AFCRL-TR-73-0144) Avail: NTIS CSCL 04/1

A satellite-borne detector for protons and alpha particles has been developed and flown. The detector uses two totally depleted silicon surface barrier detectors in a coincidence telescope arrangement to detect 5-100 MeV protons and 20-100 MeV protons and 20-100 MeV alpha particles. A calibration mode allows the front detector to be used to detect 1-5 MeV protons and 10-30 MeV alpha particles. The report contains a detailed theoretical treatment of the telescope operation, including the rejection capability for electron detection, and a description of the electronics. Results from a telescope orbiting in satellite OV5-6 are presented. Calibration mode data from quiet times show the system electronic gains to be substantially the same as before launch while data from outer trapped electron belt show the telescope to be highly immune to electron counting. (Author Modified Abstract) GRA

N73-28506# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF PROBLEMS WITH THE METHOD OF ATTACHING INDICATORS OF FATIGUE DAMAGE ACCUMULATION
G. I. Nesterenko 17 May 1973 15 p refs Transl. into ENGLISH from Vopr. Ekspuatatsionnoi Prochnosti i Nadeshnosti Aviats. Konstrukt. (Riga), v. 6, no. 191, 1971 p 39-49
(AD-761470; FTD-HT-23-255-73) Avail: NTIS CSCL 11/1

Results are given from an investigation of the strength, creep, and the transmission coefficient of adhesives used for attaching indicators. Also expounded are the results of a comparison of durability of indicators in the case of their adhesive and adhesive-rivet attachment. GRA

N73-28507# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
NOD-LR MONTHLY
May 1973 22 p
(Contract DAAK02-70-C-0162)
(AD-762351; NOD-LR-10) Avail: NTIS CSCL 20F

Contents: System engineering; Electronic circuit design; Mechanical engineering; Cryogenic engineering; Battery; Reliability and safety engineering; Human factors; Maintainability; Components and materials support; Optics; Refrigerator electronics; Manufacturing. GRA

N73-28508# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THEORETICAL MODEL OF A SPARTON MODEL 601 M HORIZONTAL VELOCITY GAGE M.S. Thesis
Elsmer Kenneth Elkins, Jr. Mar. 1973 92 p refs
(AD-762268; GE/EE/73-7) Avail: NTIS CSCL 14/2

A theoretical model of a Sparton Model 601 M horizontal velocity gage is developed. The mechanical and electrical systems of the velocity gage are treated as separate entities and separate models of each system are developed. Lagrange's equations are used to develop the mechanical equation of motion. Ampere's circuital law is used to develop the inductance equations for the electrical model. The electrical system equations are developed by applying Kirchhoff's voltage law to an equivalent circuit for the bridge network. Then by defining state variables, the overall system equations are written. A FORTRAN program was developed to solve the overall system equations using a fourth order Runge-Kutta algorithm. (Modified Author Abstract) GRA

N73-28509# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROSPECTS FOR THE USE OF THERMAL AERIAL PHOTOGRAPHY FOR THE DETECTION OF FOREST FIRES
B. V. Shilin, E. S. Artsybashev, E. Ya. Karizhenskii, and V. F. Melnikov 24 May 1973 20 p Transl. into ENGLISH from Lesn. Khoz. (Moscow), no. 7, 1969 p 52-59
(AD-762259; FTD-MT-24-1868-72) Avail: NTIS CSCL 13/12

The brief translation discusses infrared aerial photography and reviews its use in detection of forest fires. It was used in volcanology, in geological mapping, in searches for hot springs, in oceanography and hydrology. Author

N73-28510# Panametrics, Inc., Waltham, Mass.
DESIGN, FABRICATION AND FLIGHT OF A HEAVY PARTICLE IDENTIFICATION INSTRUMENT FOR SATELLITES Final Report, Feb. 1969 - Dec. 1972
Bach Sellers, Frederick A. Hanser, and Paul R. Morel May 1973 53 p refs
(Contract F19628-69-C-0234; AF Proj. 8600)
(AD-762208; AFCRL-TR-73-0216) Avail: NTIS CSCL 18/4

A particle identification instrument for measurement of protons, deuterons, tritons, 3 He and 4 He has been designed and fabricated, and it was launched on Air Force satellite S72-1 in October 1972. The instrument is basically a telescope arrangement that makes use of four silicon detectors with a plastic anticoincidence shield. Proton spectra are determined within the range 4-45 MeV, and alpha spectra between 18 and 70 MeV, with intermediate energy ranges for the other particles. Design, calibration and high quality flight results are reported, and recommendations are made for certain instrumental modifications based on these results. Author (GRA)

N73-28511# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMOELECTRIC DEVICES THROUGH WHICH FLUID IS FORCED IN THE DIRECTION OF THE HEAT FLOW
G. K. Kotyrolo and G. M. Shcherolev. 21 May 1973 12 p refs Transl. into ENGLISH from Teplofiz. i Teplotekhn., Akad. Nauk Ukr. SSR, Inst. Tekhn. Teplofiz. (Kiev), no. 19, 1971 p 132-135
(AD-761556; FTD-HT-23-411-73) Avail: NTIS CSCL 14/2

Heat transfer in a permeable thermocouple was studied. Formulas for determining the temperature drop, and the temperature of the heat transfer agent at the outlet are given along with the equations for computing the heat flow of a thermoelectric generator with a forced flow of the heat transfer agent from the hot junctions to the cold. Permeable and nonpermeable thermoelectric devices are compared. F.O.S.

N73-28512# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTRAL EQUIPMENT AND PERFORMANCE CHARACTERISTICS IN THE LONG-WAVE INFRARED REGION OF THE SPECTRUM
G. G. Gulina 18 May 1973 20 p refs Transl. into ENGLISH from Tr. Metrol. Inst. (USSR), no. 114 (174), 1970 p 22-31 (FTD Proj. T65-05-41)
(AD-762313; FTD-MT-24-1831-72) Avail: NTIS CSCL 14/2

The Russian report discusses instrumentation for far infrared spectroscopy. GRA

N73-28513# Armed Forces Radiobiology Research Inst., Bethesda, Md.
DESIGN CONSIDERATIONS FOR STOP-MOTION CINEFLUOROGRAPHY AT 500 FRAMES PER SECOND
S. A. Shatsky and S. H. Jacobson Jan. 1973 21 p refs
(AD-762412; AFRRI-TN73-1) Avail: NTIS CSCL 14/5

A prototype cinefluorographic system operable to 500 frames per second was assembled to test the feasibility of high-speed X-ray cinematography. The stop-motion capability of the device is absolute for biomedical research and is based upon a repetitively pulsing flash X-ray source with a 30-nsec exposure time. A discussion of repetition rate and resolution-limiting factors is presented in depth. Author (GRA)

N73-28514# New Mexico Univ., Albuquerque.
AN INVESTIGATION OF THE FOUR-PROBE REFLECTOMETER Technical Report, Apr. 1967 - Feb. 1968
Donald C. Thorn, John S. Potts, and Thomas R. Ermey Kirtland AFB, N. Mex. AFWL Jun. 1973 99 p refs
(Contract AF 29(601)-7097; AF Proj. 5971)
(AD-761821; AFWL-TR-73-5) Avail: NTIS CSCL 14/2

The theory of operation of the four-probe reflectometer is examined along with the types and sources of errors encountered in the determination of reflection characteristics of time-varying mismatches. Efforts to reduce error effects and equipment limitations are described in connection with the development of an operational X-band measurement system. Results are presented of experimental tests conducted to determine the accuracy of the system and its correlation with the slotted line method. Recommendations are given for improvements in the system and areas of investigation requiring future effort are suggested. Author (GRA)

N73-28521* Southwest Research Inst., San Antonio, Tex.
RADIOGRAPHY
C. Gerald Gardner *In its* Nondestructive Testing 1973 p 63-99 refs (For availability see N73-28517 19-15)
CSCL 14B

N73-28451 Reading Univ. (England).
AN APPROACH TO THE EVALUATION OF MULTISPECTRAL SCANNING SYSTEMS
R. A. G. Savigear *In* Plessey Radar Res. Centre Multispectral Scanning Systems and their Potential Appl. to Earth Resource Surveys Apr. 1973 p 7-50 refs (For availability see N73-28450 19-13)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

N73-28515* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WELDING BLADES TO ROTORS Patent
Kenneth H. Hoklo and Thomas J. Moore, inventors (to NASA) Issued 10 Jul. 1973 5 p Filed 15 Apr. 1971 Supersedes N71-34423 (09 - 21, p 3433)
(NASA-Case-LEW-10533-1; US-Patent-3,745,300;
US-Patent-Appl-SN-134658; US-Patent-Class-219-107;
US-Patent-Class-29-497.5; US-Patent-Class-27-498;
US-Patent-Class-219-62) Avail: US Patent Office CSCL 13H

A process is described to form T-joints between dissimilar thickness parts by magnetic force upset welding. This type of resistance welding is used to join compressor and turbine parts which thereby reduces the weight and cost of jet engines.
Official Gazette of the U.S. Patent Office

N73-28516* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CONTINUOUS MAGNETIC FLUX PUMP Patent
Alvin F. Hildebrandt, Daniel D. Elleman, and Frank C. Whitmore, inventors (to NASA) Issued 5 Apr. 1966 6 p Filed 29 Nov. 1961 Sponsored by NASA
(NASA-Case-XNP-01187; US-Patent-3,244,943;
US-Patent-Appl-SN-155598; US-Patent-Class-317-158) Avail: US Patent Office CSCL 13K

A method and means for altering the intensity of a magnetic field by transposing flux from one location to the location desired fro the magnetic field are examined. The device described includes a pair of communicating cavities formed in a block of superconducting material, is dimensioned to be insertable into one of the cavities and to substantially fill the cavity. Magnetic flux is first trapped in the cavities by establishing a magnetic field while the superconducting material is above the critical temperature at which it goes superconducting. Thereafter, the temperature of the material is reduced below the critical value, and then the exciting magnetic field may be removed. By varying the ratios of the areas of the two cavities, it is possible to produce a field having much greater flux density in the second, smaller cavity, into which the flux transposed.
Official Gazette of the U.S. Patent Office

N73-28517*# Southwest Research Inst., San Antonio, Tex.
NONDESTRUCTIVE TESTING: A SURVEY
Washington NASA 1973 283 p refs Sponsored by NASA (NASA-SP-5113; LC-72-600247) Avail: NTIS MF $0.95; SOD HC $3.25 Domestic Postpaid or $3.00 GPO Bookstore CSCL 14D

The principles and applications of nondestructive tests are reviewed. The methods discussed include the use of liquid penetrants, magnetic particles, X-ray radiography, ultrasonic vibrations, eddy currents, and strain sensing. For individual titles, see N73-28518 through N73-28528.

N73-28518* Southwest Research Inst., San Antonio, Tex.
NONDESTRUCTIVE TESTING: INTRODUCTION
C. Gerald Gardner *In its* Nondestructive Testing 1973 p 1-6 refs (For availability see N73-28517 19-15)
CSCL 14D

A comparison of selected nondestructive evaluation methods is presented. The properties sensed, type of flaws detected, and application for each nondestructive test are shown. F.O.S.

N73-28519* Southwest Research Inst., San Antonio, Tex.
LIQUID PENETRANTS
Richard L. Pasley *In its* Nondestructive Testing 1973 p 7-26 refs (For availability see N73-28517 19-15)
CSCL 14D

Liquid-penetrant inspection is discussed for surface defects in solids. The principle advantages are considered to be its simplicity and economy. The techniques and penetrants are described along with the developers. Commercially available equipment is also described. F.O.S.

N73-28520* Southwest Research Inst., San Antonio, Tex.
ULTRASONICS **c23**
Byron E. Leonard and C. Gerald Gardner *In its* Nondestructive Testing 1973 p 27-62 refs (For availability see N73-28517 19-15)
CSCL 20A

Ultrasonic testing is discussed as a primary means of nondestructive evaluation of subsurface flaws. The advantages and disadvantages are listed. The elementary principles, basic components of test units, scan modes, resonance testing, detection of fatigue cracks, monitoring fatigue crack growth, and determination of residual stress are discussed. F.O.S.

N73-28521* Southwest Research Inst., San Antonio, Tex.
RADIOGRAPHY **c14**
C. Gerald Gardner *In its* Nondestructive Testing 1973 p 63-99 refs (For availability see N73-28517 19-15)
CSCL 14B

Radiography is discussed as a method for nondestructive evaluation of internal flaws of solids. Gamma ray and X-ray equipment are described along with radiographic film, radiograph interpretation, and neutron radiography. F.O.S.

N73-28522* Southwest Research Inst., San Antonio, Tex.
EDDY-CURRENT TESTING

Richard L. Pasley and James A. Birdwell *In its* Nondestructive Testing 1973 p 101-117 refs (For availability see N73-28517 19-15)
CSCL 14D

Eddy-current inspection is discussed as a method for locating subsurface flaws in electrically conductive materials. The physical principles and electrical circuitry are described along with the test equipment. F.O.S.

N73-28523* Southwest Research Inst., San Antonio, Tex.
THERMAL AND INFRARED TESTING
Robert E. Engelhardt and William A. Hewgley *In its* Nondestructive Testing 1973 p 119-140 refs (For availability see N73-28517 19-15)
CSCL 14D

The detection of defective components in devices which are active heat sources, and the detection and characterization of flaws in structures that are thermally passive, but which can be nondestructively heated or cooled are described. The physical principles and thermal detectors and methods are discussed along with contact, and noncontact thermographic methods. F.O.S.

N73-28524* Southwest Research Inst., San Antonio, Tex.
MICROWAVE TECHNIQUES
William L. Rollwitz *In its* Nondestructive Testing 1973 p 141-163 refs (For availability see N73-28517 19-15)
CSCL 14D

Microwave techniques are described for the nondestructive evaluation of properties and defects in materials. The physical principles, and the applications of microwave techniques are discussed. F.O.S.

N73-28525* Southwest Research Inst., San Antonio, Tex.
MAGNETIC TESTING
Richard L. Pasley and John R. Barton *In its* Nondestructive Testing 1973 p 165-194 refs (For availability see N73-28517 19-15)
CSCL 14D

Magnetic techniques are described for the nondestructive evaluation of defects in materials. The physical principles, and the magnetic-particle method are discussed along with magnetic-hysteresis measurements and electric current perturbations. F.O.S.

N73-28526* Southwest Research Inst., San Antonio, Tex.
LEAK TESTING
Robert E. Engelhardt *In its* Nondestructive Testing 1973 p 195-224 refs (For availability see N73-28517 19-15)
CSCL 14D

Leak-testing methods for gas and liquid systems are described. The physical principles of molecular, liquid, and gas flow; relations of leak-testing methods and instrumentation; and tracer gases used in testing vacuum systems are discussed. F.O.S.

N73-28527* Southwest Research Inst., San Antonio, Tex.
STRAIN SENSING
Robert R. King and Felix N. Kusenberger *In its* Nondestructive Testing 1973 p 225-261 refs (For availability see N73-28517 19-15)
CSCL 14D

The three most generally used practical methods of strain sensing are discussed. These methods are brittle coatings, photoelastic coatings, and resistance strain gages. The physical principles of each method are reviewed. F.O.S.

N73-28528* Southwest Research Inst., San Antonio, Tex.
DEVELOPMENTAL METHODS
C. Gerald Gardner *In its* Nondestructive Testing 1973 p 263-269 refs (For availability see N73-28517 19-15)
CSCL 14D

Brief accounts are included of three nondestructive evaluation methods that have been introduced within the past few years: (1) acoustic emission, (2) the use of coherent (laser) light, and (3) ultrasonic holography. Author

N73-28529*# Ampex Corp., Redwood City, Calif.
DESIGN, FABRICATION, AND PERFORMANCE OF FOIL JOURNAL BEARING FOR THE BRAYTON ROTATING UNIT
L. Licht and M. Branger Washington NASA Jul. 1973 111 p refs
(Contract NAS3-15341)
(NASA-CR-2243; RR-72-25) Avail: NTIS HC $3.00 CSCL 13I

Foil bearings were designed and manufactured to replace pivoted-shoe journal bearings in an existing Brayton Cycle turbo-alternator-compressor. The design of this unconventional rotor support was accomplished within the constraints and space limitations imposed by the present machine, and the substitution of foil bearings was effected without changes or modification other machine components. A housing and a test rig were constructed to incorporate the new foil-bearing support into a unified assemble with an air-driven rotor and the gimbal-mounted thrust bearing, seals, and shrouds of an actual Brayton Rotating Unit. The foil bearing required no external pressure source, and stable self-acting rotation was achieved at all speeds up to 43,200 rpm. Excellent wipe-wear characteristics of the foil bearing permitted well over 1000 start-stop cycles with no deterioriation of performance in the entire speed range. Author

N73-28530*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
STUDY OF GAS TUNGSTEN ARC WELDING PROCEDURES FOR TANTALUM ALLOY T-111 (Ta-8 W-2Hf) PLATE Final Report, 1971 - 1972
R. E. Gold and R. L. Kesterson May 1973 86 p refs
(Contract NAS3-15555)
(NASA-CR-121198; WANL-M-FR-72-011) Avail: NTIS HC $6.50 CSCL 13H

Methods of eliminating or reducing underbread cracking in multipass GTA welds in thick T-111 plate were studied. Single V butt welds prepared using experimental filler metal compositions and standard weld procedures resulted in only moderate success in reducing underbread cracking. Subsequent procedural changes incorporating manual welding, slower weld speeds, and three or fewer fill passes resulted in crack-free single V welds only when the filler metal was free of hafnium. The double V joint design with successive fill passes on opposite sides of the joint produced excellent welds. The quality of each weld was determined metallographically since the cracking, when present, was very slight and undetectable using standard NDT techniques. Tensile and bend tests were performed on selected weldments. The inherent filler metal strength and the joint geometry determined the strength of the weldment. Hardness and electron beam microprobe traverses were made on selected specimens with the result that significant filler metal-base metal dilution as well as hafnium segregation was detected. A tentative explanation of T-111 plate underbread cracking is presented based on the intrinsic effects of hafnium in the weldment. Author

N73-28531*# Linguistic Systems, Inc., Cambridge, Mass.
EFFECT OF BOUNDARY SURFACE-ACTIVE VAPORS ON THE BEHAVIOR OF STEEL DURING SLIDING FRICTION
H. Uetz and J. Foehl Washington NASA Jul. 1973 16 p refs Transl. into ENGLISH from the publ. "Einfluss Grenzflaechen-aktiver Daempfe auf das Verhalten von stahl bei Gleitreibung" May 1971 p 183-187
(Contract NASw-2482)
(NASA-TT-F-14993) Avail: NTIS HC $3.00 CSCL 11/4

The wearing down of steel Ck 45 was measured at low sliding speeds on the Siebel-Kehl machine, in the presence of definite vapor concentrations of cyclohexane, water, and acetone. With increasing vapor concentration, wear increases continuously in a steam atmosphere, while a maximum forms already at quite low concentrations, with cyclohexane and acetone. The difference in the amount of wear is considerable. The environmental medium must be held constant during wear experiments. Author

N73-28532*# Hughes Aircraft Co., Los Angeles, Calif.
THIOPHENYL ETHER DISILOXANES AND TRISILOXANES USEFUL AS LUBRICANT FLUIDS Patent Application
Norman Bilow and Richard I. Akawie, inventors (to NASA) Filed 24 Jul. 1973 12 p
(Contract NAS8-25138)
(NASA-Case-MFS-22411-1; US-Patent-Appl-SN-382262) Avail: NTIS HC $3.00 CSCL 11H

The utilization of thiophenyl ether disiloxane and trisiloxanes as lubricants and functional fluids over a wide range of temperatures and environments is examined. Properties of siloxanes include resistance to nuclear and solar radiation, low vapor pressure, low pour points, and good lubricity. E.H.W.

N73-28533# Stanford Linear Accelerator Center, Calif.
BRAZING WITH COPPER AND COPPER-BASE ALLOYS
G. P. Fritzke Aug. 1972 14 p Presented at the Conf. on Copper, Metal Show and Mater. Eng. Conf., Cleveland, 16-19 Oct. 1972 Supported by AEC
(SLAC-Pub-1095) Avail: NTIS HC $3.00 CSCL 13H

Techniques for brazing copper with copper-base alloys are discussed. The procedures are specifically applied to welding wave guide sections used in an electron accelerator. The subjects presented are: (1) step brazing of disc loaded waveguides, (2) ordering problems with copper-gold braze alloy, (3) stress cracking, and (4) nondestructive tests of welded joints. Illustrations of the welding procedures and metallographic records of typical welds are provided. Author

N73-28534# Joint Publications Research Service, Arlington, Va.
INVESTIGATION OF SOME PRINCIPLES OF THE ELECTRODEPOSITION OF CYLINDRICAL MAGNETIC FILMS
I. N. Baranovskaya, A. T. Zamulyukin, O. B. Nevskiy, P. V. Nesterov, and G. M. Nurmukhamedov 26 Jul. 1973 7 p refs Transl. into ENGLISH from Sb. Nauchn. Tr. po Probl. Mikroelektron. (Moscow), no. 9, 1972 p 76-80
(JPRS-59626) Avail: NTIS HC $3.00

An investigation is reported of the effect of the deposition current density on the composition of a film at various temperatures and rates of mixing of the electrolyte. Author

N73-28535# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
APPLICATION OF SINTERING THEORY IN PRACTICE. TOPICS FOR DISCUSSION (REVISED FORM, INCLUDING COMMENTS OF ITS MEMBERS)
F. Thuemmler Dec. 1972 20 p Presented at the Intern. Team for studying Sintering Conf., Herceg Novi, Yugoslavia, 6 Sep. 1971
(KFK-1713; Conf-710978-1) Avail: AEC Depository Libraries

Development of sintering theory and practice are reviewed. Discussions are included on quantitative and qualitative theories of sintering, recommendations for experimental research, pore geometrical parameters, cooperation between metallurgists and ceramists, and methods of narrowing the gap between research and practice. NSA

N73-28536# European Space Research and Technology Center, Noordwijk (Netherlands).
METALLURGICAL EXAMINATION OF AEG CATHODE LIFE-TEST TUBES AFTER 44000 HOURS LIFE
B. D. Dunn Paris ESRO Feb. 1973 40 p
(ESRO-TM-148-ESTEC) Avail: NTIS HC $4.00

Porous-tungsten cathode/heater assemblies designed for use in traveling-wave tubes employed on board communications satellites were examined after a maximum of 44,000 hours of life testing. This metallurgical examination demonstrated the quality of manufacture of the assemblies, as well as the effect of a long continuous life on the cathode materials. Author (ESRO)

N73-28537# Naval Postgraduate School, Monterey, Calif.
SOME ASPECTS OF THE BEHAVIOR OF TWO COMPONENT PARALLEL SYSTEMS M.S. Thesis
James Franklin Helt Mar. 1973 29 p refs
Avail: NTIS CSCL 14/4

The behavior of the system hazard rate function of a two component parallel system is investigated. The inter-relationships between the probabilities that the components composing the system are alive and the system hazard rate is examined with special attention to certain points where there are important changes in the behavior of the hazard rate function. The behavior of the system hazard rate function is shown to depend upon the rates of change of the probabilities that the componets of the system are alive. Author (GRA)

N73-28538# Mechanical Technology, Inc., Latham, N.Y.
DEVELOPMENT OF COMPLIANT BEARING DESIGNS FOR DIRECTIONAL CONTROL GYROSCOPE
Richard L. Smith and Pradeep K. Gupta 25 Apr. 1973 133 p refs
(Contract DAAH01-72-C-0036)
(AD-762036; MTI-73TR19) Avail: NTIS CSCL 13/9

The report contains the analysis and experimental verification of basic operating characteristics of a flat externally pressurized elastomeric gas bearing. Pressure, films, flow and creep properties of silicone rubber are presented. Three hardnesses and layer thicknesses are examined. In addition, elastic modulus, stiffness and damping are presented. High speed (40,000 rpm) data was obtained for one tested rotor with an elastomeric molded spherical cavity bearing. The coupled elastic/hydrodynamic equations are solved. For preload deflections, the liftoff pressure is determined. The sensitivity of liftoff with Poisson's ratio is indicated. Both compressible and incompressible cases are reported. Author (GRA)

N73-28539# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FATIGUE STRENGTH OF BOLT AND RIVET JOINTS IN AIRPLANE FRAME
G. I. Nesterenko 16 May 1973 15 p refs Transl. into ENGLISH from Vopr. Ekspluatatsionnoi Prochnosti i Nadezhnosti Aviats. Konstrukt. (Riga), v. 6, no. 191, 1971 p 3-13
(AD-761446; FTD-HT-23-253-73) Avail: NTIS CSCL 13/5

The author examined the effect of friction forces on the nature of fatigue breakdown of bolt and rivet joints in aircraft structures. GRA

N73-28540# Naval Postgraduate School, Monterey, Calif.
QUALITY ASSURANCE - POLICY AND RELATED CONSIDERATIONS M.S. Thesis
Leonard Harrison Passmore Mar. 1973 71 p refs
(AD-762000) Avail: NTIS CSCL 15/5

The purpose of the paper is to examine DoD quality assurance policies and their application to Weapon System Acquisition Management. The paper is divided into six sections--Elements of Policy, DoD Quality Assurance Policy, Quality Assurance During System Procurement, Areas Needing Improvement, Project Management, and Conclusions and Recommendations. (Modified Author Abstract) GRA

N73-28541# Frankford Arsenal, Philadelphia, Pa.
RELATIONSHIPS BETWEEN BRAZING DEFECTS AND BRAZING CONDITIONS
David E. Schillinger Mar. 1973 41 p refs
(DA Proj. 1T0-62105-A-328)
(AD-762120; FA-M73-7-1) Avail: NTIS CSCL 13/8

The purpose of the work was to examine and define the causes of defects in silver-brazed steel joints, with the ultimate objective of improving the quality of such joints for army applications. Various conventional and unconventional brazing variables were examined to determine their influence on defect formation. Variables investigated included steel composition, joint clearance, time at brazing temperature, temperature at which filler metal is introduced, orientation of gravitational force flow path width, filler metal form (foil or wire), and brazing atmosphere. It was found that all joints made with flux contained large numbers of defects. The use of foil filler metals was the most helpful option in overcoming this problem in that it produced small, regularly shaped defects whereas capillary flows produced very erratic joint quality, defect size, and defect distribution. Nearly defect-free capillary flows could be achieved in argon atmospheres without fluxes. (Modified Author Abstract) GRA

N73-28542# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
INTERACTIONS AMONG THE VARIOUS PHENOMENA INVOLVED IN THE DESIGN OF DYNAMIC AND ROTARY MACHINERY AND THEIR EFFECTS IN RELIABILITY. VOLUME 1: BASIC REPORT OF REDUCED RESULTS AND UTILIZATION THEREOF Technical Report, 1 Sep. 1971 - 31 Aug. 1972
Dimitri Kececioglu, Louie B. Chester, Chester F. Nolf, Jr., Joe D. Stultz, and Anu Vaze 31 Aug. 1972 213 p refs

(Contract N00014-67-A-0209-0002)
(AD-762440; TR-5) Avail: NTIS CSCL 13/9

The report describes the continued experimental research on material behavior under fatigue testing. Cycles-to-failure testing was accomplished on fine wire, 0.040 inch diameter, made of AISI 4130, 1038, 1018 and 4340 steel. Cycles-to-failure testing was performed on AISI 4130 steel grooved rod, 0.0937 inch base diameter. Also, endurance strength, staircase tests were accomplished on AISI 1038 steel grooved rods of 0.2700 inch base diameter. These endurance strength results were used in a notch sensitivity analysis described herein. Axial fatigue testing was done on AISI 1018 steel grooved rods to generate a Goodman strength diagram. Comparison for the experimental diagrams with two theoretical diagrams is described. The results of all testing were analyzed to determine the distributional parameters. GRA

N73-28543# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
INTERACTIONS AMONG THE VARIOUS PHENOMENA INVOLVED IN THE DESIGN OF DYNAMIC AND ROTARY MACHINERY AND THEIR EFFECTS IN RELIABILITY. VOLUME 2: RESEARCH DATA Technical Report, 1 Sep. 1971 - 31 Aug. 1972
Dimitri Kececioglu, Loui B. Chester, Chester F. Nolf, Jr., Joe D. Stultz, and Anu Vaze 31 Aug. 1972 327 p
(Contract N00014-67-A-0209-0002)
(AD-762441; TR-5) Avail: NTIS CSCL 13/9

The analysis techniques which fit the normal, log sub e normal and Weibull distributions to the data are summarized and the computer programs are presented. Individual test results are listed and the results of the analysis of distributions are shown in histograms overscribed with the frequency distribution curves. GRA

N73-28544# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION OF (PISTON) GAS REFRIGERATING MACHINES AND HEAT ENGINES
A. M. Arkharov, L. S. Bondarenko, and B. G. Kuznetson 5 Jun. 1973 15 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (Moscow), no. 5, 1972 p 129-134
(AD-762261; FTD-HT-23-360-73) Avail: NTIS CSCL 13/1

The report presents theoretical relationships, making it possible by the angle of rotation to determine the main parameters of the operating process (temperature, pressure volume) in gas refrigeration machines and heat engines, operating on direct or reverse Stirling, Taconis cycles and those similar to them, and to calculate the quantity of supplied or removed heat and the work expenditures. The relationships are obtained for adiabatic processes in the working cavities taking into account the dead volumes. Author (GRA)

N73-28545# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COLLECTION OF MATERIALS FROM A SEMINAR CONFERENCE ON RELIABILITY
I. A. Bandyk, N. A. Belenkii, V. S. Pishkov, and Yu. A. Pemov 4 Jun. 1973 69 p Transl. into ENGLISH from "Sbornik Materialov Seminara-soveshchani ya po Nadezhnosti" Kishinev, 1968 p 1-53
(AF Proj. 7351)
(AD-762321; FTD-MT-24-1288-72) Avail: NTIS CSCL 14/4

Contents: Analysis of operational criteria of economy for certain instruments in the design stage in the Moldavian Instrument Industry; Experience in the operation of the reliability department of an SKB; Organization and experience in operation of the VNIINK Reliability Service; Intensified tests of submersible electric pumps. GRA

N73-28546# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
A STUDY OF WEAR REACTIONS ON MECHANICAL FACE SEALS OF NICKEL AND NICKEL-20 ATOM PERCENT MOLYBDENUM ALLOYS M.S. Thesis
E. A. Merrick Mar. 1973 151 p refs
(Contract N00014-68-A-0144)
(AD-762076; ME-73-T57-15) Avail: NTIS CSCL 11/1

The report describes continuing research on interfacial wear reactions in mechanical face seals. The wear of commercially pure nickel and nickel-20 atomic percent molybdenum was investigated. Tests were run under conditions simulating the wear of mechanical face seals, relative velocity of sliding was 975 centimeters per second. Scanning electron microscopy was used to observe and characterize surface topography. Thin film transmission electron microscopic observations of regions of the alloy cut parallel to the surface of the wear track were made. GRA

N73-28547# Defense Documentation Center, Alexandria, Va.
BEARINGS Report Bibliography, Jan. 1969 - Nov. 1972
Jun. 1973 332 p refs
(AD-761960; DDC-TAS-73-23) Avail: NTIS CSCL 13/9

The bibliography is a collection of references on bearings. The references are sequenced numerically within the following topics: (1) Airframe Bearings, (2) Ball Bearings, (3) Roller Bearings, (4) Antifriction Bearings, (5) Gas Bearings, (6) Journal Bearings. (7) Thrust Bearings, (8) Jewel Bearings, and (9) Gyroscope Bearings. Corporate Author-Monitoring Agency, Subject, Title, Personal Author, and AD Number Indexes are included. Author (GRA)

N73-28548# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF CONTROLLING THE QUALITY OF A JOINT OBTAINED BY WELDING
E. S. Karakozov, N. V. Lebedev, and V. V. Abramov 25 May 1973 6 p Transl. into ENGLISH from Russian Patent no. 266314 (7 Apr. 1971) 2 p
(AD-761587; FTD-HT-23-528-73) Avail: NTIS CSCL 13/5

A method for the control of the quality of a joint obtained by welding is described. It includes preparation of a sample for mechanical testing which has a welded joint, mounting of the sample in a test machine, placing a load on it, and preparing a thin section of the sample from the zone of the welded joint. It is characterized by the fact that for the purpose of increasing the quality of control a stress concentractor is created on the working sector and the sample is loaded up to its fracturing in the zone of the stress concentrator. GRA

N73-28549# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PRESSURE SHAPING OF METALS IN MACHINE CONSTRUCTION (SELECTED ARTICLES)
V. F. Yastrebov and N. M. Borodin 5 Jun. 1973 25 p refs Transl. into ENGLISH from Obrabotka Metallov Davleniem v Mashinostr. (USSR), no. 8, 1972 p 25-38
(FTD Proj. 60108)
(AD-762308; FTD-HT-23-121-73) Avail: NTIS CSCL 13/8

Contents: The determination of the force parameters of the spinning process; The effect of cold plastic deformation on the properties of steel and alloys during shear spinning. GRA

N73-28550# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF FRICTION IN A PART ON THE FREQUENCY OF NATURAL VIBRATIONS
V. P. Pavelko and G. V. Shakmanskii 17 May 1973 11 p refs Transl. into ENGLISH from Vopr. Eksplutatsionnoi Procnosti Nadezhnosti Aviats. Konstruk., Riga (USSR), v. 6, no. 191, 1971 p 87-92
(AD-761558; FTD-HT-23-259-73) Avail: NTIS CSCL 20/11

The article considers a change in the frequency of natural vibrations of a part with the appearance of a macrocrack. It is shown that the change can serve as source material only when estimating the dimensions of the crack, or for experimental determination of the coefficient of stress intensity. Author (GRA)

N73-28551# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMAL EXTRUSION OF STAINLESS STEELS
A. R. Orlov 18 Jan. 1973 4 p Transl. into ENGLISH from unidentified report of Akad. Nauk BSSR, Minsk, 1968
(AD-761538; FSTC-HT-23-241-73) Avail: NTIS CSCL 13/8

The article describes the effect of temperature on extrusion

of two brands of stainless steel. Thermal deformation of metals at a temperature higher than room temperature, but lower than the temperature of recrystallization makes extrusion of the metals easier. The best temperature for the two stainless steels tested was 400 C. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

N73-28552# Defence Research Establishment Valcartier (Quebec).
DISPLAY TECHNIQUES FOR A LADAR TARGET IMAGING SYSTEM
J. F. Boulter May 1973 17 p refs
(DREV Proj. 97-82-10)
(DREV-TN-2075/73) Avail: NTIS HC $3.00

A system for displaying low resolution (24 x 32 element) digital grayscale images, which is suitable for hardware implementation, was developed on a hybrid computer for use with a ladar target imaging system. A simple technique for removing the quantized nature of the image, which improves the subjective ability to recognize or identify patterns in low resolution digital images, was developed. Author

N73-28553# Defence Research Establishment Valcartier (Quebec).
[RESEARCH PROGRESS IN TEA LASERS, SURVEILLANCE TECHNIQUES, BALLISTICS TESTS, AND COMPUTER PROGRAMS FOR GUN DESIGN] Annual Report, 1972
1972 115 p refs In ENGLISH and FRENCH Original contains color illustrations
(DREV-692/73) Avail: NTIS HC $7.75

The research activities for DREV during 1972 are reported. Work is reported for the following areas: CO2 lasers, optical and acoustical surveillance, armaments, explosives and propellants, and systems analysis. Patents, and publications are listed. F.O.S.

N73-28554*# California Univ., Los Angeles. School of Engineering and Applied Science.
THE APPLICATION OF FAR IR LASERS TO THE INVESTIGATION OF THE OPTICAL PROPERTIES OF MATERIALS Final Report
O. M. Stafsudd May 1973 38 p refs
(Grant NGL-05-007-161)
(NASA-CR-132769; UCLA-ENG-7338) Avail: NTIS HC $4.00 CSCL 20E

The effect of diffusion on the saturation and absorption properties of molecular gases is considered. The analysis starts with a simple derivation of the multi-level rate equations. Incorporating the diffusion term, calculations are carried out both for the homogeneous and inhomogeneous broadening cases. Both graphical and analytical solutions are obtained for the absorption coefficient and the saturation intensity. It is shown that the effect of diffusion is characterized by a diffusion function, which varies inversely with the radius of the beam at low pressures and small beam sizes. The analysis is done in terms of two parameters k1a and k2a, which are simple functions of the intensity of the beam I, the effective relaxation rate w, and the effective diffusion constant D the a is designated as the radius of the beam. Author

N73-28555*# Radiation, Inc., Ann Arbor, Mich. Harris Electro-Optics Center.
INVESTIGATION OF USES OF HOLOGRAPHIC OPTICAL ELEMENTS Final Report, 1 Jun. 1972 - 31 May 1973
R. G. Zech and J. Latta 31 May 1973 192 p refs
(Contract NAS8-28949)
(NASA-CR-124334; Rept-8204-T-1) Avail: NTIS HC $11.75 CSCL 20E

The data represent a thorough study of the aberrations and imaging properties of holographic optical elements. Principle studies include (1) the indepth experimental investigation of single holographic optical elements, (2) the verification of the accuracy of the theoretical computer-based description of hologram behavior, (3) the computer-generation of interferograms that are characteristic of a prescribed aberrated imaging condition, (4) the experimental verification of wavelength optimization, (5) the experimental determination of the space bandwidth product of single holographic optical elements as a function of bending and field angle, and (6) the first experimental study of the aberration properties of holographic optical elements constructed in very thick (750 microns) recording media. Author

N73-28556*# Rensselaer Polytechnic Inst., Troy, N.Y. School of Engineering.
STOCHASTIC ESTIMATES OF GRADIENT FROM LASER MEASUREMENTS FOR AN AUTONOMOUS MARTIAN ROVING VEHICLE
Paul A. Burger May 1973 41 p refs
(Grant NGL-33-018-091)
(NASA-CR-133498; RPI-TR-MP-33) Avail: NTIS HC $4.25 CSCL 20E

The general problem of estimating the state vector x from the state equation h = Ax where h, A, and x are all stochastic, is presented. Specifically, the problem is for an autonomous Martian roving vehicle to utilize laser measurements in estimating the gradient of the terrain. Error exists due to two factors - surface roughness and instrumental measurements. The errors in slope depend on the standard deviations of these noise factors. Numerically, the error in gradient is expressed as a function of instrumental inaccuracies. Certain guidelines for the accuracy of permissable gradient must be set. It is found that present technology can meet these guidelines. Author

N73-28557# California Univ., Livermore. Lawrence Livermore Lab.
LASER-FUSION PROGRAM Semiannual Report, Jul. - Dec. 1971
George I. Kachen, Jr., ed. and Wallace Clements, ed. 11 Feb. 1972 101 p refs Revised
(Contract W-7405-eng-48)
(UCRL-50021-71-Rev-1) Avail: NTIS HC $3.00

Laser research and development programs dealing with solid-state, gas, and chemical lasers are described. Some experimental and theoretical studies of laser produced plasmas are briefly reviewed. NSA

N73-28558# Los Alamos Scientific Lab., N.Mex.
LASERS FOR FUSION
D. H. Gill 1973 20 p refs Presented at Southwestern Inst. of Elec. and Electron. Eng. Conf. and Exhibiton, Houston, Tex., 4 Apr. 1973 Sponsored by AEC
(LA-UR-73-224; Conf-730405-1) Avail: NTIS

A brief review of the theory of absorption of laser light by plasmas and of the necessary requirements for the production of controlled thermonuclear fusion is given. The implications of this theory in regard to the requirements on the laser to be used for fusion are discussed. The three types of lasers being considered for use (electrically pumped gas lasers, chemical, and solid-state lasers) are each described with discussion of their relative advantages and disadvantages. The Nd:glass system is described in greater detail since that system is now being used to study the basic light-matter interactions at a number of laboratories around the world. Finally, mention is made of the present status of, and future plans for, large laser systems now being built at some of those laboratories. Author (NSA)

N73-28559# European Space Research Inst., Frascati (Italy).
DYE LASERS, 1966-1972: A CLASSIFIED BIBLIOGRAPHY
G. Magyar, comp. 1973 38 p refs
Avail: NTIS HC $4.00

A classified chronological bibliography of dye lasers is presented, covering literature from 1966 to 1972. The list starts with the year 1966, when the first definitive report of a dye laser was produced by sordkin and coworkers. A subject division has been incorporated. ESRO

N73-28560# Institut Franco-Allemand de Recherches, St. Louis (France).
PRELIMINARY STUDIES OF THE ELECTRIC DISCHARGE

IN A FLOWING GAS [PHASE PREPARATOIRE A L'ETUDE DE LA DECHARGE ELECTRIQUE DANS UN GAZ EN MOUVEMENT]

B. C. Jaeggy, R. Joeckle, and G. Stern 11 Aug. 1972 26 p refs In FRENCH

(Contract DRME-71/34.337)

(ISL-20/72) Avail: NTIS HC $3.50

Electric discharges in a supersonic gas flow were investigated to increase the power of carbon dioxide lasers. This can be achieved either by vibrational excitation of a gas flow or by improving the discharge performance in order to increase the yield of electric to laser energy conversion. The theoretical and bibliographical studies on discharge modes and vibrational energy diagnostics are summarized. The experimental set up achieving a constant gas flow of 20 K/sec during 1 sec or 2 K/sec during 10 sec was completed. It consists of a high pressure (25 cu cm) and a low pressure (4.7 cu cm) reservoir separated by a membrane. The upstream reservoir empties into the downstream one after rupture of the membrane. ESRO

N73-28561# Ohio State Univ., Columbus. Electroscience Lab.

EXPERIMENTAL ABSORPTION COEFFICIENTS FOR ELEVEN CO LASER LINES Quarterly Report, 23 Jun. - 23 Sep. 1972

R. K. Long, F. S. Mills, and G. L. Trusty Mar. 1973 60 p refs

(Contract F30602-72-C-0016; ARPA Order 1279)

(AD-760140; ESL-3271-5; RADC-TR-73-126; QR-5) Avail: NTIS CSCL 07/4

The report describes experimental measurements of molecular absorption coefficients for H2O-N2 mixtures using a multipass absorption cell and a CO laser source. Eleven highly transmitting CO lines between 1854.933 and 1978.586/cm were studied. Results are compared with synthetic spectrum calculations for three different line shapes. Author (GRA)

N73-28562# United Aircraft Corp., East Hartford, Conn. Research Labs.

E-BEAM HCl LASER Semiannual Technical Report, 1 Nov. 1972 - 30 Apr. 1973

Barry R. Bronfin, John A. Shirley, and Thomas L. Churchill 31 May 1973 16 p refs

(Contract N00014-72-C-0450; ARPA Order 1807)

(AD-761671; UARL-M911340-6) Avail: NTIS CSCL 20/5

The feasibility of producing stimulated emission in the 3-5 wavelength band by exciting hydrogen chloride vibrational levels by electron impact is being investigated theoretically and experimentally. Theoretical interpretation of available transport data predicts large vibrational excitation rates. A high current density electron gun capable of sustaining a high electron density discharge has been developed and is described. The pulsed hydrogen chloride laser experiments in progress are also described. Author (GRA)

N73-28563# CBS Labs., Stamford, Conn.

COMPARISON OF LASER RECORDING/READOUT TECHNIQUES Final Report, 1 Apr. - 1 Nov. 1972

Donald Walker and William C. Harris Griffiss AFB, N. Y. RADC Apr. 1973 84 p

(Contract F30602-72-C-0290)

(AD-761521; RADC-TR-73-96) Avail: NTIS CSCL 09/2

The primary purpose of this program was to compare three types of photographic digital data recording methods using laser technology. These methods were direct digital, holographic interferometric, and holographic computer-generated recordings. It is shown that holograms are superior to direct recordings in such areas as packing density, redundancy, and ease of playback. The various techniques are also compared as to the relative ease of generating and recovering data associated with each method. Interferometric and computer-generated holograms are shown to have certain advantages which must be weighed according to the particular application involved. In addition, it is shown that acoustic-optic devices are especially suited for use in recording computer-generated holograms. The theory of operation of these devices is presented with a suggested approach for their evaluation in a breadboard recorder. Author (GRA)

N73-28564# Naval Postgraduate School, Monterey, Calif.

PULSED GAIN MEASUREMENTS ON CO2 LASERS M.S. Thesis

Daniel J. Collins and Timothy L. Houck Jun. 1972 57 p refs

(AD-761457; NPS-57C072061A) Avail: NTIS CSCL 20/5

An efficient procedure for determining the operational potential of a laser system is the experimental measurement of gain. Two laser systems, a flowing CO2-N2- laser and a chemical CO2-HN3 laser, were studied using a pulsed gain measurement technique. The experimental investigation indicated that the flowing CO2-N2 He laser system could produce lasing action and that the saturation parameter was 15 watts/ sq.cm. The experimental results for the chemical laser show a gain of approximately 8% per meter and agree qualitatively with a computer model of the CO2-HN3 laser. However, difficulties in obtaining consistent results, which were attributed to saturation of the lasing medium by the reference signal, and a low signal-to-noise ratio prevented any final conclusion. Further experimental investigation of the CO2-HN3 laser will be necessary to determine the full potential of the laser system.

Author (GRA)

N73-28565# Naval Underwater Systems Center, Newport, R.I.

HOLOGRAPHIC INVESTIGATIONS USING PULSED LASERS

Peter Shajenko 5 Apr. 1973 140 p refs

(ZF61512001)

(AD-761977; NUSC-4547) Avail: NTIS CSCL 14/5

A new source of coherent light energy is proposed for pulsed holographic applications. The proposed new source is the dye laser, whose active medium is a solution of one of several possible organic dyes. The most interesting properties of the dye laser pertinent to pulsed halography include high power capability with high efficiency, tunability across the visible spectrum, high reliability, and low cost of materials. Dyes can be selected and tuned to match the optimum transmissivity of the working medium. Because dye lasers can operate at two or more tunable frequencies, they are of potential importance in holographic contouring, which is a method for obtaining three-dimensional holographic images with range contours superimposed on the complex three-dimensional objects. The selective interaction of dye laser light with living organisms may permit minute dimensional changes to be observed. (Modified Author Abstract) GRA

N73-28566# Lick Observatory, Mount Hamilton, Calif.

OPTICS RESEARCH, 1972:2 Semiannual Report, 1 Jul. - 31 Dec. 1972

Robert H. Rediker 31 Dec. 1972 63 p refs

(Contract F19628-73-C-0002; ARPA Order 600)

(AD-762320; ESD-TR-72-364) Avail: NTIS CSCL 20/5

The report covers work of the Optics Division at Lincoln Laboratory for the period 1 July through 31 December 1972. The topics covered are laser technology and propagation, and optical measurements and instrumentation. (Modified author abstract) GRA

N73-28567# Naval Ordnance Lab., White Oak, Md.

INTERFEROMETRIC STUDIES OF THE FLOW IN FAST-EXPANDING NOZZLES

Robert A. Leverance, Elihu Zimet, and Eva M. Winkler 19 Mar. 1973 37 p refs

(AD-761601; NOLTR-73-61) Avail: NTIS CSCL 20/5

Interferometric studies have been performed in the test section of the Naval Ordnance Laboratory (NOL) 127 mm shock tunnel under conditions that closely simulate the flow in a gas dynamic laser (GDL) cavity. A Mach-Zehnder interferometer has been used to determine the density distribution in two nozzle configurations. In a two-dimensional fast-expanding nozzle, time-resolved interferograms were obtained at 200 microsecond intervals. For a multiple nozzle module interferograms were obtained in two mutually perpendicular directions. The experimental setup is described and the results are discussed. Author (GRA)

N73-28568# United Aircraft Corp., East Hartford, Conn. Research Labs.

DESIGN, FABRICATION AND DELIVERY OF A LINE SELECTABLE CO LASER Final Technical Report, 28 Feb.

1972 - 30 Nov. 1973
Carl Buczek Griffiss AFB, N. Y. RADC Mar. 1973 29 p refs
(Contract F30602-72-C-0248; ARPA Order 1279; AF Proj. 1279)
(AD-762334; RADC-TR-73-186) Avail: NTIS CSCL 20/5

The report discusses the technical background, design features, hardware and performance of a line selectable CO laser system. This laser was designed to operate with a high degree of amplitude stability and provides for line selection from 5.04 to 5.6 microns. The laser utilizes a three - element (two mirrors and one grating) optical resonator to achieve wavelength selectivity in a very high Q (low loss) optical configuration. This optimized configuration along with other design features has resulted in long term sealed tube operation with power outputs on single line from 0.1 to 1.00 W in the TEM sub (oo) mode.
Author (GRA)

N73-28569# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.
THEORETICAL STUDY OF OPTICAL PULSE PROPAGATION THROUGH RESONANT MEDIA Final Report, 1 Feb. 1971 - 31 Dec. 1972
Stephen R. Barone, Maurice C. Newstein, Nicholas Solimene, Sien Chi, and Wah Yung Chu Apr. 1973 64 p refs
(Contract F19628-71-C-0110)
(AD-762209; PIBEP-73-126; AFCRL-TR-73-0219) Avail: NTIS CSCL 20/5

The report presents the results of theoretical studies of various aspects of ultra-short pulse propagation. The main areas of progress were in: (1) Determining the stability properties of distortionless fields, (2) developing understanding of several of the processes contributing to the frequency modulation of ultra-short pulses, viz. longitudinal and transverse diffraction, non-resonant non-linearities, local field effects, Stark shifts, (3) numerical studies of the transverse behavior of ultra-shore pulses. Author (GRA)

N73-28570# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
WAVE AMPLIFICATION AND THE PRINCIPLE OF CONSERVATION OF WAVE ACTION
Ronald L. Fante 8 Mar. 1973 21 p refs
(AF Proj. 5635)
(AD-762283; AFCRL-PSRP-541; AFCRL-TR-73-0156) Avail: NTIS CSCL 20/3

Using the conservation of wave action, the author has studied the interrelationship of the electric field strength and the instantaneous frequency of an electromagnetic wave propagating in a dielectric which varies slowly with position and time. The possibility of wave amplification in such dielectrics is discussed and illustrated with examples. (Modified author abstract) GRA

N73-28571# Aerospace Corp., El Segundo, Calif.
A KINETIC MODEL AND COMPUTER SIMULATION FOR A PULSED DF-CO2 CHEMICAL TRANSFER LASER Technical Report, Jan. 1971 - Apr. 1972
Ronald L. Kerber, Norman Cohen, and George Emanuel 1 Jun. 1973 94 p refs
(Contract F04701-72-C-0073)
(AD-762284; TR-0073(3540)-2; SAMSO-TR-73-199) Avail: NTIS CSCL 20/5

The chemical and energy transfer reactions involved in the helium-diluted DF-CO2 chemical transfer laser system are discussed. Experimental and theoretical rate coefficient literature is reviewed, and the most probable rates are selected for the kinetic model of the reaction system. Results of computer experiments show the relative importance of these reactions for pulsed laser simulation. Predicted laser performance is most sensitive to values of rate coefficients for DF-CO2 transfer, collisional deactivation of CO2(00 sup 0,1) by DF, and collisional deactivation of DF(v) by D and F. A detailed investigation of the relationship of cavity and chemical mechanisms for two levels of initiation is presented for an initial composition of XF:1F2:1D2:8CO2:40He at 50 torr and 300K with X = 0.1 and 0.01. For F = 0.01, a 260-microsec pulse with 6% chemical efficiency is predicted, while the higher level initiation level (F = 0.1) produces a 52-microsec pulse with 8% efficiency.
Author (GRA)

N73-28572# California Univ., Santa Barbara.
STUDY OF THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH MATTER Semiannual Technical Status Report
H. W. Lewis 1973 7 p refs
(Grant DA-ARO(D)-31-124-72-G181; ARPA Order 1820)
(AD-762370; AROD-10265-4-P) Avail: NTIS CSCL 07/4

The report very briefly discusses a cw dye laser which has been constructed which meets all the requirements for microwave optical double resonance spectroscopy. GRA

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N73-28573* Jet Propulsion lab., Calif. Inst. of Tech., Pasadena.
PREPARATION OF ALKALI METAL DISPERSIONS Patent
Alan Rembaum and Robert F. Landel, inventors (to NASA) Issued 31 Dec. 1968 4 p Filed 14 Feb. 1966 Sponsored by NASA
(NASA-Case-XNP-08876; US-Patent-3,419,384;
US-Patent-Appl-SN-527331; US-Patent-Class-75-66) Avail: US Patent Office CSCL 11F

A method is described for producing alkali metal dispersions of high purity. The dispersions are prepared by varying the equilibrium solubility of the alkali metal in a suitable organic solvent in the presence of aromatic hydrocarbons. The equilibrium variation is produced by temperature change. The size of the particles is controlled by controlling the rate of temperature change. F.O.S.

N73-28574*# Techtran Corp., Silver Spring, Md.
EFFECT OF IRRADIATION ON THE ABSOLUTE THERMAL EMF OF METALS AND ALLOYS
A. A. Adamenko, I. Ya. Dekhtyar, and A. M. Shalayev Washington NASA Aug. 1973 12 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 34, no. 3, Sep. 1973 p 464-469
(Contract NASw-2485)
(NASA-TT-F-15015) Avail: NTIS HC $3.00 CSCL 11F

The effect of bombardment with various doses of thermal and fast neutrons, protons, deuterons, and alpha particles on the thermal EMF of Mo, Cu, Fe, Au, Pt, Pt-RH alloy, alumel, chromel, and W is measured. Some data on the changes in the composition of a group of industrial metals and alloys after a 10-year bombardment by neutrons are also included. The bombardment-induced absolute thermal EMF is found to be comparable to that caused by plastic deformation. Annealing at 300 C further increased the thermal EMF induced in Mo and W specimens by proton and deuteron bombardment. Author

N73-28575# Joint Publications Research Service, Arlington, Va.
ANNEALING OF THIN MAGNETIC FILMS AT HIGH TEMPERATURES
V. D. Verner and S. I. Mironov 26 Jul. 1973 8 p refs Transl. into ENGLISH from Sb. Nauchn. Tr. po Probl. Mikroelektron. (Moscow), no. 9, 1972 p 161-167
(JPRS-59625) Avail: NTIS HC $3.00

Results are given of an investigation of the kinetics of the change in the electrical resistance of Ni-Fe two-layer films and Ni-Fe alloys of different composition during annealing in a magnetic field. Author

N73-28576*# Rice Univ., Houston, Tex. Dept. of Chemistry.
THE EMISSIVITIES OF LIQUID METALS AT THEIR FUSION TEMPERATURES
D. W. Bonnell, J. A. Treverton, A. J. Valerga, and J. L. Margrave [1972] 10 p refs
(Grant NGL-44-006-001)
(NASA-CR-133521) Avail: NTIS HC $3.00 CSCL 11F

A survey of the literature through 1969 shows an almost

total lack of experimental emissivity data for metals in the liquid state. The emissivities for several transition metals and various other metals and compounds in the liquid state at their fusion temperatures have been determined. The technique used involves electromagnetic levitation-induction heating of the materials in an inert atmosphere. The brightness temperature of the liquid phase of the material is measured as the material is heated through fusion. Given a reliable value of the fusion temperature, which is available for most pure substances, one may readily calculate an emissivity for the liquid phase at the fusion temperatures. Even in cases where melting points are poorly known, the brightness temperatures are unique parameters, independent of the temperature scale and measured for a chemically defined system at a fixed point. Better emissivities may be recalculated as better melting point data become available. Author

N73-28577# Lockheed-Georgia Co., Marietta.
DEVELOPMENT OF A FORMABLE SHEET OF TITANIUM ALLOY Final Technical Report, Jun. 1971 - Oct. 1972
H. W. Stemme Wright-Patterson AFB, Ohio AFML Apr. 1973 127 p refs
(Contract F33615-71-C-1682)
(AD-761515; AFML-TR-73-49) Avail: NTIS CSCL 11/6

The objective of the program was to develop a metastable beta titanium sheet alloy which could be formed by standard sheet metal shop equipment and then reliably heat treated to a high strength level. It is anticipated that such an alloy will reduce initial manufacturing costs by eliminating costly hot-forming operations and by allowing greater field repair capability. Such an alloy composition was developed. It, however, did not exhibit the desired high cold formability and was not heat treatable to a high strength level with usable ductility and toughness. An alloy of a composition that resulted in cold deformation by slip exhibited a better balance of cold formability and mechanical properties after heat treatment. The alloy was Ti-3Al-15V-3Cr-3Sn. A secondary objective was the study of compositional effects as related to solutionizing cycle, cooling rate, deformation mode and heat treat response. Nineteen alloy compositions were investigated. Author (GRA)

N73-28578# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON FINITE ELASTIC-PLASTIC DEFORMATION OF METALS
P. M. Naghdi and J. A. Trapp Jun. 1973 37 p refs
(Contract N00014-69-A-0200-1008; NR Proj. 064-436)
(AD-761635; AM-73-3) Avail: NTIS CSCL 11/6

The paper is concerned with a special class of response functions for some of the constitutive equations in the nonlinear isothermal theory of elastic-plastic materials. Detailed attention is given to the development of special forms for the free energy and the stress response, motivated mainly by the mechanical behavior of ductile metals in the plastic range and in the presence of finite strains. After obtaining a properly invariant representation for the free energy response (and hence also for the stress) as a function of certain (easily interpretable) measures of deformation, the terms of the invariants of kinematic measures. Some special cases are elaborated upon and, by way of illustration, the influence of plastic deformation on the material properties of the stress response in a simple tension test is discussed. Author (GRA)

N73-28579# Frankford Arsenal, Philadelphia, Pa.
STUDY OF THE TUNGSTEN HYDROQUINONE COLOR; SPECTROPHOTOMETRIC DETERMINATION OF TUNGSTEN IN TUNGSTEN STEELS
George Norwitz and Herman Gordon Apr. 1973 33 p refs
(AD-762122; FA-T73-7-1) Avail: NTIS CSCL 11/6

An investigation was made of the red color produced by tungsten and hydroquinone in a concentrated sulfuric acid medium. Various factors affecting the color were studied including the effect of phosphoric acid, water, hydrochloric acid, stannous chloride, and wave length at which the color is measured. The interference from iron, molybdenum, vanadium, and titanium was studied. A method is described for the determination of tungsten in tungsten steels that involves precipitation of the tungsten with cinchonine, ignition to tungstic oxide, dissolution of the tungstic oxide in sodium hydroxide, and development of the tungsten hydroquinone color on an aliquot of the solution. Author (GRA)

N73-28580# Naval Research Lab., Washington, D.C.
J-INTEGRAL CHARACTERIZATION OF IRRADIATED STAINLESS STEELS Interim Report
E. J. Loss and R. A. Gray, Jr. 25 Apr. 1973 28 p refs
(Contract AT(49-5)-2110; RR0221141)
(AD-761611; NRL-7565) Avail: NTIS CSCL 11/6

The J-integral was investigated as a method of characterizing the elastic plastic toughness level of structural materials used in advanced fast reactors. J is defined in an introductory sense, and several approximate methods for its evaluation on the basis of a single specimen test are highlighted. Initial J evaluations are presented for irradiated 304 stainless steel in the annealed and cold-worked conditions and for 308 stainless steel weld deposit. Results indicate that cold-worked material will exhibit a significantly lower toughness than the annealed material in both irradiated and unirradiated conditions. Radiation significantly degrades the toughness of the annealed material while showing relatively little effect on the cold-worked specimens. The toughness of the unirradiated weld deposit is shown to be significantly less than that of the unirradiated plate. Finally, practical difficulties relating to a meaningful interpretation of the observed behavior are discussed as areas where current research efforts should be directed. Author (GRA)

N73-28581# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE QUESTION OF CALCULATING FATIGUE STRENGTH OF STEELS WITH A SYMMETRIC LOADING CYCLES
I. N. Shkanov and Yu. L. Kozhevnikov 17 May 1973 16 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 136, 1971 p 15-24
(AD-761469; FTD-HT-23-265-73) Avail: NTIS CSCL 11/6

An analysis of existing criteria for fatigue strength with asymmetrical loading cycles was conducted. It was shown that a universal criterion suitable for a description of the behavior of all materials is presently absent. Criteria of fatigue strength with a complex stressed state were analyzed and the possibility of their applicability for cases of the combination of a variable bend and biaxial static tension was shown. A criterion of fatigue strength which corresponds to the complex course of the experimental curves was proposed. GRA

N73-28582# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF DEFORMATION RATE ON THE DUCTILITY OF METALS AND ALLOYS
V. G. Kononenko and S. G. Kushnarenko 6 Jun. 1973 13 p refs Transl. into ENGLISH from Samoletostr. Tekh. Vozdush. Flota (USSR), no. 17, 1970 p 116-120
(AF Proj. 7351)
(AD-762246; FTD-HT-23-179-73) Avail: NTIS CSCL 11/6

The purpose of the study was to establish the maximum degree of deformation (until the first visible crack) under free swaging of the specimens and to study the rapid drop forging in order to determine the possibility and peculiarities of high-speed volumetric deformation. GRA

N73-28583# Army Foreign Science and Technology Center, Charlottesville, Va.
PRODUCT STRENGTHENING BY PLASTIC DEFORMATION
V. N. Shalin 18 Apr. 1973 214 p refs Transl. into ENGLISH from an unidentified Russian monograph
(AD-762468; FSTC-HT-23-1136-72) Avail: NTIS CSCL 13/8

The solutions and analytical analyses of problems of bending and torsion, which greatly facilitate calculations with consideration of deformation reinforcements and residual stresses, are examined in this book. The problem of plastic deformation of rods made of cold-worked materials with different resistances to expansion and comparision is discussed. The results of this solution are important for determination of complex form changes of products (warping) after various disruptions of equilibrium of internal forces (heating, etching, mechanical processing, etc). Several typical examples illustrating the practical application of

the recommended methods are examined. The book is intended for scientists and engineers working with problems of plastic deformation. Author (GRA)

N73-28584# Little (Arthur D.), Inc., Cambridge, Mass.
EFFECT OF APPLIED ELECTRIC FIELDS ON THE MECHANISMS OF OXIDATION OF METALS AND ALLOYS Final Report, 18 Dec. 1971 - 18 Dec. 1972
Joan B. Berkowitz, W. David Lee, Edward T. Peters, and William E. Lyle 18 Dec. 1972 69 p refs
(Contract N00019-72-C-0217)
(AD-762074; ADL-74206-FR) Avail: NTIS CSCL 11/6

The effect of an applied electric field on oxidation/hot corrosion was investigated in a molten salt of Na2SO4 and in a salt seeded propane air flame. Nichrome metal strips were used in the investigation of the effect of applied electric fields on corrosion. Marked reduction on the level of corrosion was demonstrated with the anodic electrode in the salt bath at a threshold applied current level of 1.39 ma/sq. The chromium content of the alloy appears to play a critical role in promoting the anodic protection, nickel alone is insufficient. An effect of an applied electric field on corrosion in a salt seeded flame was observed. At the anode, scanning electron probe measurements verify that the oxide ion loses electrons and hence the oxide activity is reduced relative to the sulfur activity. Author (GRA)

N73-28585# Manlabs, Inc., Cambridge, Mass.
COMPUTER ANALYSIS OF ALLOY SYSTEMS Final Technical Report, May 1971 - Jan. 1973
Larry Kaufman and Harvey Nesor Mar. 1973 146 p refs
(Contract F33615-71-C-1471; AF Proj. 7353)
(AD-761814; AFML-TR-73-56) Avail: NTIS CSCL 11/6

Computer analysis of twenty-three binary and thirteen ternary titanium and columbium base systems were performed in order to provide phase stability and thermochemical characterization data which can be used to define fabrication procedures for achieving high temperature stability and improved mechanical properties. M sub s temperatures were calculated for titanium base alloys with simultaneous additions of Mo, V, Al, Mn and Sn. The effect of zirconium on the solubility of Si and Be in hcp titanium was calculated along with the occurrence of miscibility gap formation in bcc titanium base systems. Titanium and columbium base ternary systems were analyzed to predict the temperature-composition trajectories of eutectoid and eutectic troughs and the location of melting point minima. A method was developed for calculation of the eutectic temperature and composition of metal alloy-metal carbide systems and applied to the Fe,Ni,Cr-TiC case. Author (GRA)

N73-28586# Ballistic Research Labs., Aberdeen Proving Ground, Md.
X-RAY TOPOGRAPHY OF SHOCK LOADED COPPER CRYSTALS
P. W. Kingman May 1973 22 p refs
(DA Proj. 1T0-61101-A-91A)
(AD-762146; BRL-1647) Avail: NTIS CSCL 11/6

Single crystals of high purity copper subjected to shock loading have been examined by X-ray diffraction topography. The topographs reveal a basic substructure consisting of narrow, close packed kinks normal to highly stressed slip directions and extending rather homogeneously throughout the sample. In the vicinity of fractures, where gross macroscopic deformation occurs, complex interactions are observed. The substructure has been examined as a function of orientation and pressure.
Author (GRA)

N73-28587# Battelle Columbus Labs., Ohio.
ENGINEERING DATA ON NEW AEROSPACE STRUCTURAL MATERIALS Final Summary Report, Apr. 1972 - Apr. 1973
Omar L. Deel, Paul E. Ruff, and H. Mindlin Jun. 1973 149 p
(Contract F33615-72-C-1280; AF Proj. 7381)
(AD-762305; AFML-TR-73-114) Avail: NTIS CSCL 11/6

The major objectives of the research program were to evaluate newly developed materials of interest to the Air Force for potential structural airframe usage, and to provide data sheet type presentations of engineering data for these materials. The effort covered in the report has concentrated on X2048-T851 plate, 7050-T73651 plate, 21-6-9 annealed sheet, Ti-8Mo-8V-2Fe-3Al STA sheet, Ti-6Al-2Zr-2Sn-2Mo-2Cr STA plate, and Ti-6Al-6V-2Sn STA isothermal die forgings. The properties investigated include tension, compression, shear, bend, impact, fracture toughness, fatigue, creep and stress-rupture, and stress corrosion at selected temperatures. Author (GRA)

N73-28588# Birmingham Univ. (England). Dept. of Physical Metallurgy and Science of Materials.
THERMODYNAMICS OF ALLOYS: SOLID ELECTROLYTE STUDIES AND SOLUTION CALORIMETRY OF NICKEL-GALLIUM ALLOYS Final Technical Report
J. N. Pratt, J. M. Bird, and S. Martosudirdjo Mar. 1973 41 p refs
(Contract DAJA37-72-C-3034; DA Proj. 2O0-61102-B-31E; DA Proj. 2O0-61102-B-14C)
(AD-762337; ARDG(E)-E-1544) Avail: NTIS CSCL 11/6

Reversible galvanic cells with zirconia-calcia solid electrolytes and either Pt-O (air) or Ni-O reference electrodes were used to determine thermodynamic properties of solid Ni-Ga alloys at temperatures between 837 and 1100K. Activities, free energies, entropies and heats of formation were obtained for the Ni-rich fcc solid solutions and for the Ni3Ga, Ni2Ga, Ni3Ga2, NiGa and Ni2Ga3 phases. All the above properties are characterised by negative deviations from ideality. The exothermic heats of formation of alloys and their differences from similar Pd-based phases are discussed in relation to their electronic structures. An analysis of the entropies of formation into their probable configurational, electronic, magnetic and vibrational components is suggested. Thermodynamic evidence for substitutional and vacancy defect structures in NiGa was examined. Preliminary results of tin-solution calorimetric measurements of heats of formation of the solid alloys, the above phases and Ni3Ga7 at 300K are presented. (Modified Author Abstract) GRA

N73-28589# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
SOLID-STATE CHEMICAL REACTIONS IN ALLOY STEELS AT ELEVATED TEMPERATURES Final Report, 1 Apr. 1970 - 31 Mar. 1973
John Chipman and John F. Elliott 5 Jun. 1973 19 p refs
(Contract DAHC04-67-C-0036; DA Proj. 2O0-61102-B-32D; AROD Proj. 6513-MC)
(AD-762361; AROD-6513-15-MC) Avail: NTIS CSCL 11/6

The principal objective of the project was to secure accurate laboratory data which could serve as a basis for a complete thermodynamic description of the changes occurring in the heat treatment of carbon and alloy steels. The important changes considered are the transformations from liquid to solid, and from austenite to ferrite, and precipitations of graphite, cementite and other carbides from the liquid or solid phases, particularly from austenite. A secondary objective was the thermodynamic treatment of solutions of interstitial and non-metallic elements in metallic solvents. The interstitial element is carbon dissolved in f.c.c. iron, and recent interest has centered on the effects of alloying elements. For such a solution, the usual form of Henry's law must be modified and a new and relatively simple thermodynamic treatment has been developed. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N73-28590*# Battelle Columbus Labs., Ohio.
THERMOPHYSICAL PROPERTIES OF PLASMA SPRAYED COATINGS
K. E. Wilkes and J. F. Lagedrost Mar. 1973 148 p refs
(Contract NAS3-13329)
(NASA-CR-121144) Avail: NTIS HC $9.50 CSCL 11D

Thermophysical properties of plasma sprayed materials were determined for the following plasma sprayed materials: CaO - stabilized ZrO2, Y2O3 - stabilized ZerO2, Al2O3, HfO2 Mo,

nichrome, NiAl, Mo-ZrO2, and MoAl2O3 mixtures. In all cases the thermal conductivity of the as-sprayed materials was found to be considerably lower than that of the bulk material. The flash-laser thermal diffusivity technique was used both for diffusivity determination of single-layer materials and to determine the thermal contact resistance at the interface of two-layer specimens. Author

N73-28591*# Grumman Aerospace Corp., Bethpage, N.Y.
DEVELOPMENT OF A CLOSED PORE INSULATION MATERIAL
Albert Tobin, Carl Feldman, Michael Russak, and Joseph Reichman Washington NASA Jul. 1973 180 p refs
(Contract NAS1-10713)
(NASA-CR-2254) Avail: NTIS HC $3.00 CSCL 11D

A closed pore ceramic foam insulation material (CPI) has been developed that offers possibilities for use as a reusable external heat shield for the NASA manned space shuttle. The outstanding characteristics of CPI are: (1) negligible water absorption due to a noninterconnecting network of cells; (2) high emittance at room and elevated temperature; (3) ability to survive at least 10 simulated reentry cycles to 1500 K using radiant heat lamps to simulate the reentry heat fluxes; (4) ability to survive, with no change in properties or appearance, at least 10 simulated plasma arc jet cycles to 1500 K (with the exception of some stress cracks induced either by the unduly severe nature of the initial arc splash heating pulse or by improper mechanical holding of the specimen in the test fixture); (5) strength (flexure); and (6) a low thermal conductivity throughout the temperature range of interest for the space shuttle. Author

N73-28592*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE APPLICATION OF SPACE PROGRAM FIRE RETARDANT TECHNOLOGY TO HOUSING
S. R. Riccitiello and K. W. Heising Washington Aug. 1973 17 p refs
(NASA-TN-D-7370; A-4874) Avail: NTIS HC $3.00 CSCL 11D

A review of the NASA fire research and developed fire retardant materials is presented with the objective to analyze and evaluate the concepts and materials to determine the practical applicability to the housing industry. The report presents the NASA materials, their performance in a fire environment and areas where further evaluation is required. The review establishes where advancements in the state of the art have been achieved and points out reasons why these advancements can not be directly applied to the housing industry in the near future.
Author

N73-28593*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.
THE INTERACTION BETWEEN INCLUSIONS AND CRACKS
F. Erdogan May 1973 28 p refs
(Grant NGR-39-007-011)
(NASA-CR-132292; IFSM-73-42) Avail: NTIS HC $3.50 CSCL 11D

Some current fracture theories are reviewed and a group of mechanics problems of practical interest relating to the elastic interaction between cracks and inclusions are identified and results summarized. Author

N73-28594*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIELECTRIC CONSTANT AND LOSS TANGENT OF ECCOFOAM PT, AT 2.3 GHz, FOR VARIOUS PACKING DENSITIES
F. L. Lane 15 Jul. 1973 10 p Revised
(Contract NAS7-100)
(NASA-CR-133550; JPL-TR-32-1433-Rev-1) Avail: NTIS HC $3.00 CSCL 11D

The dielectric constant and loss tangent for Eccofoam PT, at various densities, are determined; the resulting density gradients are provided. The range of densites over which the dielectric constant and loss tangent are determined are from approximately 320 to 1280 kg/cu m (20 to 80 lb/cu ft). Author

N73-28595*# Public Technology, Inc., Washington, D.C.
DEVELOPMENT AND EVALUATION OF THERMOPLASTIC STREET MAINTENANCE MATERIAL Final Report, 12 Feb. - 11 Jul. 1973
Warren D. Siemens 11 Jul. 1973 149 p refs
(Contract NASw-2388)
(NASA-CR-133549) Avail: NTIS HC $9.50 CSCL 11D

An all-weather permanent street patching material was investigated for flexible and rigid pavements. The economic, operational, and material requirements are discussed along with the results of field tests with various mixtures of EVA resins and asphalt. Cost analyses for thermoplastic patching methods are included. F.O.S.

N73-28596# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
MEASUREMENTS OF THE EFFECTS OF THERMAL AND/OR UV VACUUM RADIATION ON POLYMERS
P. C. vanderWaal 27 Apr. 1972 124 p refs
(Contract ESTEC-647/69-AA)
(RV-106; ESRO-CR(P)-250) Avail: NTIS HC $8.25

Measurements of the effects of thermal and/or UV vacuum radiation on polymers are presented. Test equipment is described, with particular attention to the UV vacuum facility and the measurements of the UV radiation dosage. The process specification for the preparation and testing of samples is added. The materials subject to investigation are adhesives, thermoplastics, and thermosetting resins, which were exposed to thermal vacuum and plastic films which were exposed to UV vacuum. For the thermal vacuum exposed materials the effects due to vacuum and to temperature were separated by statistical calculations. The possibility of making the UV vacuum test a standard one is considered. Author (ESRO)

N73-28597# Midwest Research Inst., Kansas City, Mo.
EFFECT OF FILAMENT-MATRIX INTERDIFFUSION ON THE FATIGUE RESISTANCE OF BORON-ALUMINUM COMPOSITES
J. R. Hancock and G. G. Shaw 6 Jun. 1973 21 p refs
(Contract N00014-70-C-0212; NR Proj. 031-743)
(AD-761658; TR-6) Avail: NTIS CSCL 11/4

The effects of diffusion across filament-matrix interfaces and the role of weak interfacial bonds on the axial fatigue resistance of boron-6061 aluminum composites were determined. Interfacial microstructures and composite fatigue resistance were compared with those previously determined for current, state-of-the-art boron-6061 aluminum composites. It was concluded that (a) the fracture behavior of the SiC coating on coated boron-filaments preferentially degrades the low-cycle fatigue resistance of composites, (b) the fatigue resistance of current, state-of-the-art boron-6061 aluminum composites can be improved substantially, (c) weak interfacial bonds extend the fatigue life of boron-6061 aluminum composites, and (d) increased diffusion penetration across boron-6061 aluminum interfaces shortens composite fatigue life by a detectable but minimal amount. Author (GRA)

N73-28598# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
MECHANICAL PROPERTIES OF THERMAL BARRIER MATERIALS PROGRAM Final Report, 15 Jan. 1972 - 15 Feb. 1973
K. E. Muszar and N. B. Edenborough Mar. 1973 76 p refs
(Contract N00019-72-C-0148)
(AD-762045; DDAD-EDR-7786) Avail: NTIS CSCL 11/3

The objectives of the program were: Fabricate, by arc plasma spraying, test specimens using specific mixtures of Hastelloy X and zirconium dioxide (Hx-ZrO2); Determine mechanical properties of the Hx-ZrO2 specimens in both the as-sprayed condition and after exposure to high temperature thermal environments for times up to 1000 hrs; and Evaluate metallographically the test samples to correlate changes in microstructural characteristics with changes in tested mechanical properties. GRA

N73-28599# Illinois Univ., Urbana. Electromagnetics Lab.
A NEW METHOD FOR MEASURING DIELECTRIC PROPERTIES OF MATERIAL MEDIA USING MICROSTRIP CAVITY
Mitsutake Sato and Tatsuo Itoh Apr. 1973 58 p refs
(Grants DA-ARO(D)-31-124-71-G77; NSF GK-36854)

(AD-762359; UIEL-73-5; UILU-ENG-73-2544; AROD-5405-37-E) Avail: NTIS CSCL 14/2

A new non-destructive method is developed for measuring the dielectric properties of slab-type materials. The method uses a simple and rapid substitution procedure yielding accurate results. One begins by measuring the resonance frequency and the Q factor of a microstrip cavity with the reference material placed on top of the cavity. The reference material may be conveniently taken to be the same as the substrate. Then, the reference material is replaced by the unknown dielectric material, and the measurements for the resonance frequency and the Q factor are repeated. The two sets of data are then processed to derive the dielectric properties of the unknown material. Several examples of the measured data by this method are also included and it is confirmed that the present method is quite reliable and yet simple in operation. Author (GRA)

N73-28600# Naval Research Lab., Washington, D.C.
TENSOR MANIPULATIONS IN COMPLEX COORDINATES WITH APPLICATION TO THE MECHANICS OF MATERIALS
Final Report
Phillip W. Mast 18 May 1973 33 p refs
(NRL Proj. F01-04; RR0090345)
(AD-761994; NRL-7537) Avail: NTIS CSCL 11/4

Research into the strength and failure of composite materials is benefited substantially by the development of tensor manipulation techniques in complex coordinates which insure a problem representation that is compact, simple, and invariant. Such techniques are developed through the introduction of several new notations and integer functions. The techniques are then applied to problems connected with analytic formulations in composite materials research, such as basic formulation of anisotropic plane-linear elasticity theory, the elastic constants of laminated composites, graphic representation of tensor transformations, and tensor-polynomial approximation functions to yield surfaces. The techniques are general and can be used whenever two-dimensional tensor formulations are desired. Author (GRA)

N73-28601# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Center.
THERMOPHYSICAL PROPERTIES OF ATJS GRAPHITE
Technical Report, 1 Jan. - 30 Jun. 1972
Raymond E. Taylor Oct. 1972 32 p refs
(Contract F33615-72-C-1531; AF Proj. 7381)
(AD-762301; AFML-TR-72-195) Avail: NTIS CSCL 11/2

The thermal conductivity and electrical resistivity of ATJS graphite were measured from 1300 to 2550 K in the across-grain direction. This supplements earlier measurements in the with-grain direction. The use of a computer-based data acquisition system significantly increased both the accuracy and precision of the measurements. The hemispherical total emittance and normal spectral emittance (0.65 micometers) were also measured and the changes caused by oxidation were noted. It was found that both emittances increased upon oxidation. It was also noted that the normal spectral emittance increased upon long term storage. Author (GRA)

N73-28602# Brown Univ., Providence, R.I. Engineering Materials Research Lab.
THERMAL EXPANSION INSTABILITY AND EFFECT ON CREEP OF POLYURETHANE
W. N. Findley and R. M. Reed May 1973 21 p refs
(Contract DAHC15-67-C-0217; Grant NSF GH-33631)
(AD-762458; MRL-E-87; EMRL-56) Avail: NTIS CSCL 11/9

It was found that thermal expansion of polyurethane decreased markedly in several hundred hours. After heating the thermal expansion decreased gradually at constant temperature; after cooling the thermal contraction decreased with time but more slowly. The role of cross linking as a cause of this effect is discussed. Creep during the expanded phase after heating is shown to be much greater than creep after thermal expansion has stabilized at the same temperature. Experiments are described which show that the effect of temperature on creep results primarily from thermal expansion rather than from thermal oscillation. Author (GRA)

N73-28603# Essex Univ., Colchester (England). Dept. of Physics.
PLASTIC DEFORMATION OF C-AXIS SAPPHIRE FILAMENTS
R. E. Tressler and D. J. Barber Mar. 1973 51 p refs Prepared in cooperation with Pa. State Univ., University Park Sponsored in part by NSF
(Contract F33615-71-C-1606; AF Proj. 7351)
(AD-762302; AFML-TR-73-25) Avail: NTIS CSCL 11/2

The yielding and flow behavior in uniaxial, constant strain rate tensile tests of single crystal sapphire filaments oriented with the tensile axis parallel to the filament axis was studied in the temperature range from 1760C to 1875C. The existence of a strain-ageing effect leading to non-reproducible upper yield points was established. The flow stress followed a power law dependence on strain rate with stress exponents ranging from 8.50 at 1775C to 12.4 at 1875C. The apparent activation enthalpies calculated from constant temperature experiments reflect a flow stress dependence on temperature which includes both substructure and deformation mechanism temperature dependencies. The preliminary activation enthalpies calculated from differential planes are identified as the dominant slip planes with the 1/3 -1,1,0,1 = Burgers vectors inferred from the testing geometry. Author (GRA)

N73-28604# Army Natick Labs., Mass.
SUSCEPTIBILITY OF MIL-L-23699 (ACFT TURBOSHAFT ENGINE, SYNTHETIC LUBE OIL) AND MIL-L-7808 LUBRICATING OIL ACFT TURBINE ENGINE, SYNTHETIC BASE) OILS TO MICROBIAL ATTACK
Morris R. Rogers, Arthur M. Kaplan, and Joseph J. Vitaliano Apr. 1973 26 p refs
(DA Proj. 1T0-62110-A-031)
(AD-762176; USA-NLABS-TR-73-54-PR) Avail: NTIS CSCL 11/8

A 6-month tropic service test of the OH-58A Helicopter System conducted at Fort Clayton, Canal Zone revealed that the tail rotor transmission oil level sight gage did not indicate the correct oil level because fungal growth plugged the sight gage drain holes. A sample of the MIL-L-23699 oil revealed it would readily support fungal and bacterial growth. A survey and test program to determine the microbial susceptibility of the MIL-L-23699 and MIL-L-7808 synthetic engine and transmission lubricants was undertaken. Of the 33 QPL samples of new and used lubricants obtained, only three were found to be resistant to microbial attack. The test microorganisms appeared to attack both the pentaerythritol and trimethylolpropane major basestock components with equal ease. The three microbially resistant products were all manufactured by one company and microbial resistance was probably due to either a side-effect of the gear load carrying additive employed or its instability in the test system employed. (Modified Author Abstract) GRA

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N73-28605*# National Aeronautics and Space Administration, Washington, D.C.
ON THE OPERATOR THEORY OF n-TH DEGREE MODULAR FORMS
M. Koecher Aug. 1973 59 p refs Transl. into ENGLISH from Math. Ann. (Leipzig), v. 130, 1956 p 351-368
(NASA-TT-F-15006) Avail: NTIS HC $5.00 CSCL 12A

Operators are defined that go beyond the first trial solution for the generalization of the Hecke operators and have farther reaching properties; the operator ring generated by them is investigated as analog to the complex multiplication of Abelian functions. The operator is defined for each integer invertible matrix of n rows and columns by means of a representative system of the generalized transformations of g-th order. Since the operator maps the form assembly for one of the invariance groups in another such assembly, the transition from one assembly to another is completed at the same time. G.G.

N73-28606*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DATA COMPRESSION PRESERVING STATISTICAL INDEPENDENCE

George E. Morduch (Old Dominion System, Inc.) and William M. Rice May 1973 33 p refs

(NASA-TM-X-70419; X-591-73-143) Avail: NTIS HC $3.75 CSCL 12A

The purpose of this study was to determine the optimum points of evaluation of data compressed by means of polynomial smoothing. It is shown that a set y of m statistically independent observations Y(t sub 1), Y(t sub 2), ... Y(t sub m) of a quantity X(t), which can be described by a (n-1)th degree polynomial in time, may be represented by a set Z of n statistically independent compressed observations Z (tau sub 1), Z (tau sub 2),...Z (tau sub n), such that The compressed set Z has the same information content as the observed set Y. The times tau sub 1, tau sub 2,.. tau sub n are the zeros of an nth degree polynomial P sub n, to whose definition and properties the bulk of this report is devoted. The polynomials P sub n are defined as functions of the observation times t sub 1, t sub 2,.. t sub n, and it is interesting to note that if the observation times are continuously distributed the polynomials P sub n degenerate to legendre polynomials. The proposed data compression scheme is a little more complex than those usually employed, but has the advantage of preserving all the information content of the original observations. Author

N73-28607*# Connecticut Univ., Storrs.

A REDUCED ADAPTIVE OBSERVER FOR MULTIVARIABLE SYSTEMS

Robert L. Carroll and D. P. Lindorff Jun. 1973 30 p refs

(Grant NGL-07-002-002)

(NASA-CR-133429; TR-73-3) Avail: NTIS HC $3.50 CSCL 12A

An adaptive observer for multivariable systems is reported for which the dynamic order of the observer is reduced, subject to mild restrictions, to n-p+l where n is the order of the system being observed and p is the number of independent output measurements. The observer structure which is developed depends directly upon the multivariable structure of the system rather than a transformation to a single output system. The number of adaptive gains is at most the sum of the order of the system and the number of input parameters being adapted. Moreover, for the relatively frequent specific cases for which the number of required adaptive gains is less than the sum of system order and input parameters, the number of these gains is easily determined by inspection of the system structure. Author

N73-28608# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computing.

THE SOLUTION OF HELMHOLTZ' EQUATION IN EXTERIOR DOMAINS USING INTEGRAL EQUATIONS Ph.D. Thesis - London Univ.

A. J. Burton Jan. 1973 141 p refs

(NPL-NAC-30) Avail: NTIS HC $9.25

The classical formulation of wave scattering problems in terms of integral equations is reviewed, and it is shown that the integral equations, unlike the problems they represent, may not possess unique solutions for particular values of the wavenumber. The failure is associated with the existence of eigenfunctions for the interior of the scattering obstacle. Several recent integral equation formulations are discussed which are designed to overcome these difficulties, and form a suitable basis for numerical solution.

Author (ESRO)

N73-28609# Stuttgart Univ. (West Germany). Inst. A fuer Mechanik.

APPLICATION OF THE THEORY OF OPTIMAL CONTROL AND PARAMETER OPTIMIZATION IN OPERATIONS RESEARCH [ANWENDUNG DER THEORIE OPTIMALER STEUERUNG UND PARAMETEROPTIMIERUNG IN DER UNTERNEHMENSFORSCHUNG]

G. Heess and U. Clauss Bonn Bundeswehramt 1973 71 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Verteidigung

(BMVg-FBWT-73-9) Avail: NTIS HC $5.75; Bundeswehramt 25 DM

The theory of differential games was applied to problems in military operations research. Continuous differential games described by differential equations and discrete differential games (multistage games) described by differential equations were considered. Continuous differential games were applied to local conflict situations; as an example, an antiballistic missile (ABM-)problem was investigated. Multistage games are especially suited for the investigation of global conflicts. As an example, the time variable optimal employment of military formations during a war was considered. Finally, the different applications of differential games in military operations research are discussed.

Author (ESRO)

N73-28610# Rice Univ., Houston, Tex. Aero-Astronautics Group.

SOME PROPERTIES OF THE SEQUENTIAL GRADIENT-RESTORATION ALGORITHM AND THE MODIFIED QUASI-LINEARIZATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH BOUNDED STATE

H. Y. Huang and A. Esterle 1972 27 p refs

(Grant AF-AFOSR-2185-72; AF Proj. 9749)

(AD-761790; AAR-106; AFOSR-73-1021TR) Avail: NTIS CSCL 12/1

The sequential gradient-restoration algorithm and the modified quasilinearization algorithm were developed for optimal control problems with bounded state. These algorithms have a basic property: for a subarc lying on the state boundary, the state boundary equations are satisfied at every iteration, if they are satisfied at the beginning of the computational process. Thus, the subarc remains anchored on the state boundary. In the paper, the anchoring conditions are derived. Author (GRA)

N73-28611# Naval Postgraduate School, Monterey, Calif.

PARAMETER PLANE METHODS FOR LINEAR SYSTEMS WITH TIME DELAY M.S. Thesis

Anthony Ch. Hadjiconstandis Mar. 1973 191 p refs

(AD-761761) Avail: NTIS CSCL 12/1

After a brief introduction on the parameter plane methods, the behavior of simple systems with time delay has been initially studied by the root-loci method and then the state of the art of parameter plane methods with time delay has been presented. A variation of the solution in the state of the art presentation has been derived and an appropriate digital computer program has been constructed. As an extension of studies in the parameter plane, a three variable parameter system has been approached by using basic descriptive geometry properties and simple illustrative examples have been worked out in the parameter space. Finally, a real life system with time delay has been analysed and redesigned by parameter plane methods.

Author (GRA)

N73-28612# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF THE COMPUTATION OF UPPER CONFIDENCE LEVELS IN A SERIES SYSTEM M.S. Thesis

Brent Dean Foster Mar. 1973 54 p refs

(AD-761758) Avail: NTIS CSCL 12/1

A comparison of several techniques is presented for determining upper confidence levels for a system failure rate. A series system of components with exponential failure rates is examined. Classical computational techniques are compared with Bayesian techniques in determining the upper confidence level of a system failure rate. A sensitivity analysis is conducted on several of the parameters as part of the comparison.

Author (GRA)

N73-28613# Naval Postgraduate School, Monterey, Calif.

STOCHASTIC APPROXIMATION: A SURVEY M.S. Thesis

Thomas Keith Scheber Mar. 1973 104 p refs

(AD-761766) Avail: NTIS CSCL 12/1

Since 1951 when Robbins and Monro's pioneering paper on stochastic approximation was published, many articles have appeared dealing with extensions, modifications, methods and applications of stochastic approximation. While the concepts involved are relatively simple, but mathematically difficult, the information concerning specific results has been widely scattered and difficult to collect for the interested researcher. The paper will attempt to discuss the major results and will provide the

necessary references to direct the user to more specific findings. Author (GRA)

N73-28614# Rice Univ., Houston, Tex. Aero-Astronautics Group.
MODIFIED QUASILINEARIZATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH BOUNDED STATE VARIABLES. PART 1: THEORY
A. Miele, K. H. Well, and J. L. Tietze' 1972 53 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-761786; AAR-103-Pt-1; AFOSR-73-1024TR-Pt-1) Avail: NTIS CSCL 12/1

The paper considers the numerical solution of optimal control problems involving a function subject to differential constraints, a state variable inequality constraint, and terminal constraints. The problem is to find the state x(t), the control u(t), and the parameter pi so that the functional is minimized, while the constraints are satisfied to a predetermined accuracy. (Modified Author Abstract) GRA

N73-28615# Rice Univ., Houston, Tex. Aero-Astronautics Group.
MODIFIED QUASILINEARIZATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH BOUNDED VARIABLES. PART 2: EXAMPLES
A. Miele, K. H. Well, and J. L. Tietze 1972 75 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-761791; AAR-105; AFOSR-73-1025TR) Avail: NTIS CSCL 12/1

Miele, Well, and Tietze developed the modified quasilinearization algorithm for minimizing a functional subject to differential constraints, a state variable inequality constraint, and terminal constraints. In the report, six numerical examples are presented, four pertaining to the fixed-final-time case and two pertaining to the free-final-time case and two pertaining to the free-final-time case. The numerical results show the rapid convergence characteristics of the modified quasilinearization algorithm. Author (GRA)

N73-28616# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
SOME RESTRICTIONS ON CONSTITUTIVE EQUATIONS
R. S. Rivlin May 1973 45 p refs
(Contract N00014-67-A-0370-0001)
(AD-761624; CAM-100-19) Avail: NTIS CSCL 20/11

In the paper, the author discusses a number of inequalities which it has been suggested, by various authors, must be satisfied by the strain-energy function for an isotropic elastic material. These include the Coleman-Noll inequality, numerous inequalities proposed by Truesdell and Toupin, the Baker-Ericksen inequality and inequalities resulting from the retirement that all speeds of propagation of waves of infinitesimal amplitude, in the statically deformed material, be real. It is shown that there is no compelling reason why the Coleman-Noll inequality or the various inequalities of Truesdell and Toupin discussed in the present paper should be satisfied. Of course, they may be satisfied for particular materials. Author (GRA)

N73-28617# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SEQUENTIAL GRADIENT RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH BOUNDED STATE VARIABLES. PART 1: THEORY Interim Report
G. R. Hennig and A. Miele 1972 64 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-761787; AAR-101; AFOSR-73-1022TR) Avail: NTIS CSCL 12/1

The paper considers the numerical solution of optimal control problems involving a functional I subject to differential constraints, a state variable inequality constraint, and terminal constraints. The problem is to find the state x(t), the control u(t), and the parameter pi so that the functional is minimized, while the constraints are satisfied to a predetermined accuracy. The approach taken is a sequence of two-phase processes or cycles, composed of a gradient phase and a restoration phase. Modified Author Abstract) GRA

N73-28618# Rice Univ., Houston, Tex. Aero-Astronautics Group.
SEQUENTIAL GRADIENT RESTORATION ALGORITHM FOR OPTIMAL CONTROL PROBLEMS WITH BOUNDED STATE VARIABLES. PART 2: EXAMPLES Interim Report
G. R. Hennig and A. Miele 1972 73 p refs
(Grant AF-AFOSR-2185-72; AF Proj. 9749)
(AD-761789; AAR-102; AFOSR-73-1023TR) Avail: NTIS CSCL 12/1

Hennig and Miele developed the sequential gradient-restoration algorithm for minimizing a function subject to differential constraints, a state variable inequality constraint, and terminal constraints. In the report, six numerical examples are presented, four pertaining to the fixed-final-time case and two pertaining to the free-final-time case. The numerical results show the rapid convergence characteristics of the sequential gradient-restoration algorithm. Author (GRA)

N73-28619# Wisconsin Univ., Madison. Mathematics Research Center.
THE ALGEBRA OF CONICAL PROJECTIONS
Eduardo H. Zarantonello Apr. 1973 27 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-761867) Avail: NTIS CSCL 12/1

A concise presentation of the algebra of projections on convex cones in Hilbert space is given. Author (GRA)

N73-28620# Air Force Academy, Colo. Dept. of Aeronautics.
A NUMERICAL TECHNIQUE FOR OPTIMAL CONTROL PROBLEMS WITH INITIAL CONDITION
Jerry D. Hines Jun. 1973 25 p refs
(AD-762253; DFAN-TR-73-3) Avail: NTIS CSCL 12/1

The gradient technique is applicable to optimal control problems with initial conditions. The final value of the independent variable may be fixed or unknown. The method is based on an iterative procedure for determining the Lagrange multipliers associated with the terminal constraints. The method has the advantage of a rapid convergence rate as the solution is approached and allows for second or higher order corrections to the control variable history. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N73-28621# National Weather Service, Silver Spring, Md. Techniques Development Lab.
AN APPLICATION OF MODEL OUTPUT STATISTICS TO THE PREDICTION OF CEILING AND VISIBILITY Final Report on Phase 1, Mar. 1971 - Mar. 1973
Joseph R. Bocchier, Harry R. Glahn, and Frank T. Globokar Mar. 1973 68 p refs
(Contract DOT-FA67WAI-131; Proj. 152-461-014)
(FAA-RD-73-14) Avail: NTIS HC $5.50

The model output statistics (MOS) approach is used in thie report to develop prediction equations for ceiling and visibility. MOS consists of determining a statistical relationship between a prediction and the forecast output of numerical prediction models. The statistical relationship was determined by screening regression with the two numerical models: the National Meteorological Center's primitive equation model and the Techniques Development Laboratory's subsynoptic advection model. Author

N73-28622*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
COST ANALYSIS OF ATMOSPHERE MONITORING SYSTEMS
M. M. Yakut 31 May 1973 37 p refs
(Contract NAS8-28377)
(NASA-CR-124331; MDC-G4580) Avail: NTIS HC $4.00 CSCL 04B

The cost analyses of two leading atmospheric monitoring systems, namely the mass spectrometer and the gas chromato-

graph, are reported. A summary of the approach used in developing the cost estimating techinques is presented; included are the cost estimating techniques, the development of cost estimating relationships and the atmospheric monitoring system cost estimates. Author

N73-28623# Stockholm Univ. (Sweden). Inst. of Meteorology.
THEORETICAL AND PRACTICAL PROBLEMS IN FORMULATING BOUNDARY CONDITIONS FOR A LIMITED-AREA MODEL
Arne Sundstroem (Swed. Natl. Defence Res. Inst.) May 1973 26 p refs Presented at the WMO/IAMAP Symp. on Mesoscale Meteorol. Systems and Fine-Mesh Modelling, Reading, Engl., 14-18 May 1973
(DM-9) Avail: NTIS HC $3.50

Numerical models for the integration of meteorological forecast equations within a limited part of the atmosphere are examined. It was shown that previous conclusions concerning the number of boundary quantities to be prescribed and the method of finding additional conditions for numerical approximation are correct. Other data cover techniques for analyzing certain sets of boundary conditions to determine its adequacy and numerical stability. The application of these techniques to the barotropic system of primitive forecast equations and baroclinic forecast equations with pressure as the vertical coordinate is discussed. Author (ESRO)

N73-28624# Naval Postgraduate School, Monterey, Calif.
NORMALIZED SPECTRA OF TURBULENT FLUCTUATIONS OVER OCEAN WAVES M.S. Thesis
Robert John Stricker Mar. 1973 45 p refs
(AD-761504) Avail: NTIS CSCL 04/2

Spectral and cospectral analyses are performed on turbulence data obtained over natural ocean waves during BOMEX. Results are obtained for normalized spectra and cospectra. Significant scatter is observed throughout the spectra and cospectra with a larger degree of scatter in the low frequency range. Kolmogorov's -5/3 power law is found to describe the longitudinal and vertical velocity spectra in the high frequency range. However, it is not applicable to the lateral velocity spectra while results for the temperature spectra are inconclusive. Monin-Obukhov similarity theory well describes the vertical velocity spectra yet its application to horizontal velocity spectra is doubtful. Similarity theory does not seem to adequately describe the uw cospectra. Results from comparing similarity theory to temperature spectra and wT cospectra indicate the presence of an influence not accounted for by similarity theory. (Modified Author Abstract) GRA

N73-28625# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT AND APPLICATION OF AN ANALOG SCHEME FOR PREDICTING THE INTENSIFICATION OF WESTERN NORTH PACIFIC TROPICAL CYCLONES M.S. Thesis
Kent William Foster Mar. 1973 96 p refs
(AD-761726) Avail: NTIS CSCL 04/2

Various meteorological parameters were examined to determine their predictive value for forecasting intensity changes of Western North Pacific tropical cyclones using an analog forecast scheme. A number of procedures were devised to quantitatively define the forecast potentials of these parameters in a systematic method. Based on the results of these procedures, predictors for the 24-hour, 48-hour, and 72-hour forecast periods were defined. To evaluate the skill of the predictors and the procedures used to define them, an analog intensification forecast scheme was developed and applied to a number of test cyclones. (Modified Author Abstract) GRA

N73-28626# Naval Postgraduate School, Monterey, Calif.
NUMERICAL EXPERIMENTS WITH A FIVE LEVEL GLOBAL ATMOSPHERIC PREDICTION MODEL USING A STAGGERED, SPHERICAL, SIGMA COORDINATE SYSTEM Ph.D. Thesis
William Theodore Elias Mar. 1973 63 p refs
(AD-761386) Avail: NTIS CSCL 04/2

Three cases of analytic data and one case of real data were numerically integrated using a 5-level baroclinic primitive equations model of the general circulation. Experiments were performed using initial winds derived from the linear balance equation and also winds derived analytically. The feasibility of using the linear balance equation to initialize the wind field was examined. In all cases, the forecasts remained meteorological and reasonably well-behaved. Nevertheless, the forecasts derived from initial winds generated by the linear balance equation excited large, operationally-undesirable inertial-gravity waves, while the forecasts from analytically determined initial winds remained free of such small scale noise. Author (GRA)

N73-28627# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF REGIONAL EXTREME MODEL ATMOSPHERES BY REGRESSION METHODS M.S.Thesis
Donald A. Quinn Mar. 1973 59 p refs
(AD-761474) Avail: NTIS CSCL 04/2

A group of stations in the North American Arctic region have been analyzed for statistical determination of temperatures at mandatory pressure levels. For each station the temperature at a key level, peculiar to that station, has forced in at the first step and retained at each subsequent step, in the development of stepwise regression equations which predict temperatures at the mandatory levels. In general, eight-step predictions, in terms of interlevel thicknesses, were found to give optimum specification of the desired temperatures. The best estimate of the regional atmosphere, which is conditionally dependent upon the existence of an extreme 1% probability of the forcing level temperature, is obtained with a high degree of confidence. Author (GRA)

N73-28628# Naval Weather Service Command, Washington, D.C.
NORTH PACIFIC TROPICAL CYCLONE VECTOR MEAN CHARTS
Harold L. Crutcher (Natl. Climatic Center) Jul. 1973 118 p
(AD-762044) Avail: NTIS CSCL 04/2

The paper presents resultant directions and distances for tropical cyclone movements in the Eastern and Western North Pacific. Charts present the movements for separate five-degree latitude-longitude quadrangle areas for five seasons in the Eastern North Pacific and eight seasons in the Western North Pacific for six time intervals. In addition, the charts provide sufficient information to allow the user to construct 0.90 bivariate normal probability ellipses of the movements. Author (GRA)

N73-28629# Naval Postgraduate School, Monterey, Calif. Dept. of Meteorology.
EVALUATION OF THE FLEET NUMERICAL WEATHER CENTRAL OPERATIONAL PRIMITIVE EQUATION MODEL IN FORECASTING EXTRATROPICAL CYCLOGENESIS M.S. Thesis
Timothy David Klopfenstein Mar. 1973 77 p refs
(AD-761727) Avail: NTIS CSCL 04/2

The paper describes an attempt to find systematic errors in the 12, 24 and 36-hour sea-level pressure forecasts of extratropical cyclogenesis produced by the operational five-layer primitive-equation model of the Fleet Numerical Weather Central, Monterey, California. The sample was extracted from the storm season spanning the period October 1971 through March 1972. Several systematic errors exist. When compared to the National Meteorological Center's six-layer primitive-equation model, Fleet Numerical Weather Central's model showed comparable or superior performance. (Modified Author Abstract) GRA

N73-28630# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
SYNTHETIC VERIFICATION MATRICES, 1 Air Force Surveys in Geophysics
C. N. Touart 13 Mar. 1973 28 p refs
(AF Proj. 8628)
(AD-761485; AFCRL-TR-73-0158; AFCRL-AFSIG-260) Avail: NTIS CSCL 04/2

Two approximations for the verification matrix of a subjective weather forecast are compared. Neither requires more information than the climatological frequencies of the forecast categories and the skill score of the forecast. The more accurate synthesis yields an RMS error of less than 0.01 for the 16 elements of a 4-category aviation terminal forecast. Author (GRA)

N73-28631# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

FOG MODIFICATION: A TECHNOLOGY ASSESSMENT Air Force Surveys in Geophysics.
Bernard A. Silverman and Alan I. Weinstein 12 Mar. 1973 46 p refs
(AF Proj. 7605)
(AD-762207; AFCRL-TR-73-0159; AFCRL-AFSIG-261) Avail: NTIS CSCL 04/2

The report is a comprehensive review of fog modification. It includes discussions of the physical structure and climatological characteristics of various types of fog. The three different methods of fog modification, that is, removal, evaporation and prevention are discussed, as are the general requirements of fog dispersal. In depth descriptions are given of the techniques used to modify supercooled, warm, and ice fog. Author (GRA)

N73-28632# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 13401 HONEST JOHN, MISSILE NO. 1763, ROUND NO. 685 RML (20 APRIL 1973) Meteorological Data Report
Apr. 1973 30 p
(DA Proj. 1T6-65702-D-127)
(AD-762158; DR-775) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13401 Honest John, Missile Number 1763, Round Number 685 RML, are presented in tabular form. Author (GRA)

N73-28633# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 13401 HONEST JOHN MISSILE NO. 2542, ROUND NO. 634 RMI (18 APRIL 1973) Meteorological Data Report
Apr. 1973 29 p
(DA Proj. 1T6-65702-D-127)
(AD-762157; DR-774) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13401 Honest John, Missile Number 2542, Round Number 634 RMIL, are presented in tabular form. Author (GRA)

N73-28634# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITY OF CALCULATING CLOUD-COVER FIELD ON THE BASIS OF VERTICAL VELOCITY DATA
Z. N. Fathullaeva 24 May 1973 11 p refs Transl. into ENGLISH from the Interpretation and use of Satellite Data in the Analysis and Forecasting of Weather (USSR), 1971 p 48-52
(AD-761545; FTD-HT-23-373-73) Avail: NTIS CSCL 04/2

The article is concerned with the possibility of calculating the total cloud-cover on the basis of data pertaining to vertical velocities. Data supplied by meteorological satellites is used. GRA

N73-28635# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
PROPANE DISPENSER FOR COLD FOG DISSIPATION SYSTEM Final Report
J. R. Hicks and T. E. Lukow Jan. 1973 38 p refs Sponsored by AF
(AF Proj. 5559; AF Proj. 433L)
(AD-762292; ESD-TR-73-208) Avail: NTIS CSCL 04/2

The following topics are discussed: Nozzle design; Pressurization system design; Amount of propane needed to clear airfields; and Cost analysis. GRA

N73-28636# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 13401 HONEST JOHN, MISSILE NO. 305, ROUND NO. 633 RML (12 APRIL 1973) Meteorological Data Report
Apr. 1973 30 p
(DA Proj. 1T6-65702-D-127)
(AD-762155; DR-772) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 13401 Honest John, Missile Number 305, Round Number 633 RML, are presented in tabular form. Author (GRA)

N73-28637# Rochester Univ., N.Y.
BARIUM CLOUD GROWTH AND STRIATION IN A CONDUCTING BACKGROUND Final Technical Report, 15 Mar. - 15 Nov. 1972
Jeng-Nan Shiau and Albert Simon Nov. 1972 43 p
(Contract F30602-70-C-0001; ARPA Order 1057; AF Proj. 1057)
(AD-761828; RADC-TR-72-320) Avail: NTIS CSCL 04/1

Previous calculations of barium cloud growth failed to give reasonable estimates of striation scale size and onset time because they either assumed no ionospheric end-shorting or no ion diffusion (all modes unstable) or strong shorting (all modes stable). The authors derive a set of equations which include finite end-shorting and solve by a new numerical technique. For moderate end-shorting (in the experimental range) a fastest growing mode of reasonable size on the rear of the cloud is obtained. The growth rates and instability range are very sensitive to the end-shorting and magnitude of the ambient electric field. There is no growth below a critical value of E or above a critical value of the shorting. A series of graphs are presented. The authors also derive most previous results as special cases of our equations. Author (GRA)

N73-28638# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11604 LANCE MISSILE NO. 2238, ROUND NO. 187 RCT (4 MAY 1973) Meteorological Data Report
May 1973 48 p refs
(DA Proj. 1T6-65702-D-127)
(AD-762162; DR-779) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11604 Lance, Missile Number 2238, Round Number 187 RCT, are presented in tabular form. Author (GRA)

N73-28639# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
ATHENA H-010, FLIGHT 140 (26 APRIL 1973)
Len E. Carter Apr. 1973 60 p refs
(DA Proj. 1T6-65702-D-127-02)
(AD-762160; DR-777) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of Athena Flight 140, Vehicle H-010, are presented for the Air Force Space and Missile Systems Organization and for ballistic studies. The data are presented in tabular and figure form. Author (GRA)

N73-28640# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELECTION OF A FIRST APPROXIMATION FOR NUMERICAL SOLUTION TO THE BOUNDARY VALUE PROBLEMS OF ATMOSPHERIC DYNAMICS
B. M. Ilin and L. V. Rukhovets 15 May 1973 13 p refs Transl. into ENGLISH from Chislennyi Prognoz Pogody i Teoriya Klimata (USSR), no. 272, 1972 p 88-93
(AD-761574; FTD-HT-23-188-73) Avail: NTIS CSCL 04/2

The numerical solution of certain problems of hydrodynamic forecasting and general atmospheric circulation leads to the solution of the boundary value problem for an elliptical equation for each step and to the transition from step to step using one or another approximation formula. For example, the numerical integration of the vorticity equations in the quasi-geostrophic and the quasi-solenoidal approximations leads to such a procedure. The problem is discussed in the report. GRA

N73-28641# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 15601 LITTLE JOHN MISSILE NO. 3165, ROUND NO. 699 AM
27 Apr. 1973 18 p
(DA Proj. 1T6-65702-D-127)
(AD-762161; DR-778) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 15601 Little John, Missile Number 3165, Round Number 699 AM, are presented in tabular form. Author (GRA)

N73-28642# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE 11604 LANCE MISSILE NO. 2239, ROUND NO. 188 RCT (19 APRIL 1972)

Apr. 1973 31 p
(DA Proj. 1T6-65702-D-127)
(AD-762156; DR-773) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 11604 Lance, Missile Number 2239, Round Number 186 RCT, are presented in tabular form. Author (GRA)

N73-28643# Army Electronics Command, Fort Monmouth, N.J.
DATA FROM A FOG DISPERSAL EXPERIMENT USING HELICOPTER DOWNWASH
W. S. Nordquist May 1973 267 p refs
(DA Proj. 1T0-61102-B-53A)
(AD-762189; ECOM-5456) Avail: NTIS CSCL 04/2

Data from a series of helicopter downdraft fog-clearing experiments are presented in tabular form, one set for each of six test days. This information has been prepared in this format to allow analysis of the experiments without recourse to original data and to make available time histories of the meteorological characteristics of advection fogs of the type to be found along the northern California coast. Author (GRA)

N73-28644# Weather Wing (3rd), Offutt AFB, Nebr.
THERMAL PARAMETERS AS A PREDICTOR OF PRECIPITATION TYPE FOR CARSWELL AFB, TEXAS
Limon E. Fortner, JR. and Billie E. Grubbs Apr. 1973 16 p refs
(AD-762289; Rept-3WW-TN-73-2) Avail: NTIS CSCL 04/2

The paper presents a summary of thermal parameters as predictors of precipitation type at Carswell AFB, Texas. The material presented in this paper may be used to make an objective forecast when the input data are extracted from current observations and prognastic facsimile charts. The Greater Southwest Airport (GSW), Fort Worth, Texas, radiosonde data (for 0000Z and 1200Z) are correlated against precipitation type that occurred at Carswell AFB, Texas, within plus or minus three hours of radiosonde time. Thermal parameter combinations used in this study are: 1000-850mb thickness, 1000-700mb thickness, 1000-500mb thickness; surface and 950mb temperatures. Author (GRA)

N73-28645# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. CHINESE-PHILIPPINE COASTAL MARINE AREAS. VOLUME 3. AREA 9: HONG KONG, AREA 10: LUZON N. E., AREA 11: LUZON N. W., AREA 12: HAINAN S. E. Apr. 1973 642 p refs
(AD-762423) Avail: NTIS CSCL 04/2

The data contained in these tables were from Tape Data Family 11 Marine Surface Observations. The areas discussed include: Hong Kong; Northeastern and Northwestern Luzon; and Southeastern Hainan. GRA

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N73-28646*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANNULAR MOMENTUM CONTROL DEVICE USED FOR STABILIZATION OF SPACE VEHICLES AND THE LIKE Patent Application
Willard W. Anderson and Nelson J. Groom, inventors (to NASA) Filed 1 Aug. 1973 11 p
(NASA-Case-LAR-11051-1; US-Patent-Appl-SN-384773) Avail: NTIS HC $3.00 CSCL 22B

An annular momentum control device used for stabilization of space vehicles is described. The device provides spacecraft stability about two axes. The body of the space vehicle is mounted coaxially with the axis of rotation of an annular-shaped inertial mass. A linear induction motor drives the inertial mass. The body is located within the annulus which provides a topological advantage and permits the increase of the radial dimension of the stabilizing mass which results in the generation of a greater stabilizing force than in vehicles having different body-stabilizing mass configurations. NASA

N73-28647# Federal Aviation Administration, Washington, D.C.
ENGINEERING AND DEVELOPMENT PROGRAM PLAN: AIR TRAFFIC CONTROL TECHNOLOGY
1 Jul. 1973 47 p
(FAA-ED-16-1) Avail: NTIS HC $4.50

The Technology Program Plan which is published to document the engineering and development activities of the Federal Aviation Administration is presented. It described current and planned activities to examine advanced concepts and techniques and to evaluate their application in the air traffic control environment. The program is divided into two major categories: data entry and display technology and advanced computer technology. Author

N73-28648# Stanford Research Inst., Menlo Park, Calif.
ANALYSIS OF AUTOMATIC AIRCRAFT ALTITUDE REPORTING USING THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM Final Report, Jun. 1972 - Apr. 1973
G. J. Couluris Apr. 1973 116 p refs
(Contract DOT-FA70WA-2142; SRI Proj. 8181)
(FAA-RD-73-44) Avail: NTIS HC $8.00

Work measuring the degree of relative correspondence between simultaneous automatic aircraft altitude reports and oral altitude reports from pilots recorded on magnetic tape at two FAA terminal area ATC facilities and one enroute ATC facility is reported. The frequency of occurrence of the resulting observed deviations between automatic and pilot reports are tabulated by deviation magnitude and by phase of operation (i.e., climb, descent, and level) and control facility; probable causes of observed deviations are identified. Author

N73-28649*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
DEVELOPMENT OF A WIDTH-MODULATED PULSE REBALANCE ELECTRONICS LOOP FOR STRAPDOWN GYROSCOPES
T. V. Blalock, E. J. Kennedy, and R. D. McKnight 13 Jul. 1973 65 p refs
(Contract NAS8-27296)
(NASA-CR-124333; S-25) Avail: NTIS HC $5.25 CSCL 17G

A new width modulated pulse rebalance electronics loop was developed for use with strapdown gyroscopes. Advantages of the width modulated binary over the ternary loop are the following: (1) The H-switch is easier to implement; (2) torque is applied in finely quantized increments; (3) the analog-to-digital conversion for data generation is inside the loop and is directly determined by the torque pulse; (4) on part of the loop compensation network bypasses the gyroscope; and (5) the torquer is fed constant power. Author

N73-28650# National Aerospace Lab., Amsterdam (Netherlands).
SIMULATION PROGRAMS FOR AIR TRAFFIC SURVEILLANCE
C. R. Traas Paris ESRO Feb. 1973 62 p refs
(Contract ESTEC-1341/71)
(ESRO-CR-81) Avail: NTIS HC $5.25

Programs were developed for simulating the determination of airplane positions from radar range observations via a pair of stationary satellites, and for simulating the determination of these satellite orbits from radar range and range-rate observations. The program, SPATS 1, for calculating aircraft positions from range measurements between a ground station and each of the airplanes via the satellites, and SPATS 2, for calculating the initial state vector of a pair of stationary satellites from a set of range measurements or from a set of range and range-rate measurements, are described. Concerning SPATS 1 and SPATS 2 program, at each measurement both stationary satellites and two ground stations are involved. ESRO

N73-28651# Naval Electronics Lab. Center, San Diego, Calif.
VLF NAVIGATION
E. Swanson and F. C. Robie 1 Jan. 1973 38 p

(Contract DOT-FA73WAI-343; NELC Proj. A206)
(AD-761498; NELC-TD-233) Avail: NTIS CSCL 17/7

Very-low-frequency (VLF) radio signals offer potential advantages for aircraft area navigation. This document defines the aircraft navigation problem from the operational viewpoint and describes pertinent aspects of VLF propagation. Advantages and disadvantages of promising approaches to system design are noted. It is concluded that many system designs will provide true continental area navigation capability with redundancy and reliability. Author (GRA)

N73-28652# Environmental Prediction Research Facility (Navy), Monterey, Calif.
A NUMERICAL STUDY IN OPTIMUM TRACK SHIP ROUTING CLIMATOLOGY
Frederick W. Nagle (Natl. Environ. Satellite Serv., Washington, D. C.) Sep. 1972 170 p refs
(AD-761620; ENVPREDRSCHFAC-TP-10-72) Avail: NTIS CSCL 17/7

A brief discussion of the background and history of optimum track ship routing is presented. The basic problems are formulated and the approach used in this investigation is described. The computing scheme is described graphically and textually. The results of this investigation are presented in two forms: (1) computer-generated histograms showing mean time saved by month for various trans-Atlantic routes; and (2) computer-drawn charts of various routes, by class (described), plotted against 5-year surface and 500-mb means. Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N73-28653*# Georgia Inst. of Tech., Atlanta.
SATELLITE NUCLEAR POWER STATION: AN ENGINEERING ANALYSIS
Mar. 1973 147 p refs
(Grant NGR-11-002-145)
(NASA-CR-121254) Avail: NTIS HC $9.50 CSCL 18E

The satellite nuclear power station (SNPS), remotely operated in synchronous orbit, is discussed, transmitting power safely to the ground by a microwave beam. Fuel reprocessing would take place in space and no radioactive materials would be returned to earth. For individual titles, see N73-28654 through N73-28658.

N73-28654* Georgia Inst. of Tech., Atlanta.
INTRODUCTION
J. R. Williams *In its* Satellite Nucl. Power Station: An Eng. Anal. Mar. 1973 p 3-22 (For availability see N73-28653 19-22)
CSCL 18E

.Objections to nuclear power are enumerated. Four potential types of reactors are proposed for using a closed cycle nuclear MHD system. These reactors include a NERVA-type solid core reactor, the colloid core reactor, the light bulb gas core reactor, and the coaxial flow gas core reactor. Three different types of closed cycle nuclear MHD power plant systems are analyzed to determine the operating characteristics, critical parameters, and performance. Each power plant's three component subsystems are also described, including: (1) the high temperature reactor with attached MHD generator and uranium separator, (2) the compressor system, and (3) the heat rejection system. J.A.M.

N73-28655* Georgia Inst. of Tech., Atlanta.
MHD GENERATOR PERFORMANCE LIMITATIONS
R. J. Rosa *In its* Satellite Nucl. Power Station: An Eng. Anal. Mar. 1973 p 23-28 (For availability see N73-28653 19-22)
CSCL 18E

The electrical properties of the gas are the primary limiting factor to MHD generator performance; the most relevant electrical properties are the conductivity and the Hall parameter. The maximum allowable pressure at several given levels of power extration vs. temperature is represented graphically. J.A.M.

N73-28656* Georgia Inst. of Tech., Atlanta.
NUCLEAR ANALYSIS
J. D. Clement and K. D. Kirby *In its* Satellite Nucl. Power Station: An Eng. Anal. Mar. 1973 p 29-61 (For availability see N73-28653 19-22)
CSCL 18E

Exploratory calculations were performed for several gas core breeder reactor configurations. The computational method involved the use of the MACH-1 one dimensional diffusion theory code and the THERMOS integral transport theory code for thermal cross sections. Computations were performed to analyze thermal breeder concepts and nonbreeder concepts. Analysis of breeders was restricted to the (U-233)-Th breeding cycle, and computations were performed to examine a range of parameters. These parameters include U-233 to hydrogen atom ratio in the gaseous cavity, carbon to thorium atom ratio in the breeding blanket, cavity size, and blanket size. Author

N73-28657* Georgia Inst. of Tech., Atlanta.
POWER PLANT SYSTEMS ANALYSIS
J. R. Williams and Y. Y. Yang *In its* Satellite Nucl. Power Station: An Eng. Anal. Mar. 1973 p 63-118 (For availability see N73-28653 19-22)
CSCL 18E

Three basic thermodynamic cycles of advanced nuclear MHD power plant systems are studied. The effect of reactor exit temperature and space radiator temperature on the overall thermal efficiency of a regenerative turbine compressor power plant system is shown. The effect of MHD pressure ratio on plant efficiency is also described, along with the dependence of MHD power output, compressor power requirement, turbine power output, mass flow rate of H2, and overall plant efficiency on the reactor exit temperature for a specific configuration. J.A.M.

N73-28658* Georgia Inst. of Tech., Atlanta.
COSTS AND APPLICATIONS
J. R. Williams *In its* Satellite Nucl. Power Station: An Eng. Anal. Mar. 1973 p 119-139 (For availability see N73-28653 19-22)
CSCL 18E

Assuming an emissivity of 0.9, the total area required for SNPS radiators was calculated. An SNPS producing 13,000 MW of electrical power at an overall thermal efficiency of 56% would reject about 10,000 MW of heat. If the radiator has a length three times its width, then the width of the radiator base may be calculated as a function of radiator temperature. There are two such radiators used with the power plant. The base of a 750 K radiator for a 13,000 MWe SNPS would measure 200 meters, and its length would be 600 meters. At 1000 K, these dimensions are cut almost in half. Author

N73-28659*# Westinghouse Astronuclear Lab., Pittsburgh, Pa.
COMPACT THERMOELECTRIC CONVERTER SYSTEMS TECHNOLOGY Final Report
Jun. 1973 453 p refs Prepared for Atomics Intern.
(NASA Order C-21029-C; Contracts AT(04-3)-701; N854-0051)
(NASA-CR-121210; WANL-PR(EEE)-055) Avail: NTIS HC $24.75 CSCL 18I

A schematic of the developed tubular thermoelectric module is shown. It consists of alternate washers of n- and p-type lead telluride, separated by thin natural mica washers. Electrical continuity within the circuit is accomplished by cylindrical conductor rings located at the I.D. and O.D. of the lead telluride washers. The conductor rings are also separated by the same mica which separate the lead telluride washers. The result is a radially serpentine current path along the length of the module. The circuit is isolated from the structural claddings by thin sleeves of boron nitride. Circuit containment and heat transfer surfaces are provided by the inner and outer cladding, heat being transferred from a heat source at the inner clad, conducted radially outward through the lead telluride to the outer clad where the waste heat is removed by a heat rejection system. Author

N73-28660*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ION EXCHANGE NUCLEAR REACTOR Patent Application
John L. Power, inventor (to NASA) Filed 3 Jul. 1973 28 p (NASA-Case-LEW-11645-2; US-Patent-Appl-SN-376258) Avail: NTIS HC $3.00 CSCL 18I

A fuel system is described for a thermal nuclear reactor which utilizes an ionorganic ion exchanger to retain nuclear fuel in the reactor core. A circulating aqueous solution supplies the fuel to the ion exchanger, removes the fuel from the ion exchanger, acts as a moderator, effects control of the reactor power, and removes deleterious products from the reactor core portion of the fuel system. NASA

N73-28661*# Atomics International, Canoga Park, Calif.
THE 5-kwe REACTOR THERMOELECTRIC SYSTEM SUMMARY
J. H. VanOsdol, ed. 27 Jul. 1973 214 p refs Sponsored by NASA
(Contract AT(04-3)-701; Proj. SNAP)
(NASA-CR-121241; AI-AEC-13096; M-3679-R69; C-92B) Avail: NTIS HC $12.75 CSCL 18I

Design of the 5-kwe reactor thermoelectric system was initiated in February 1972 and extended through the conceptual design phase into the preliminary design phase. Design effort was terminated in January, 1973. This report documents the system and component requirements, design approaches, and performance and design characteristics for the 5-kwe system. Included is summary information on the reactor, radiation shields, power conversion systems, thermoelectric pump, radiator/structure, liquid metal components, and the control system. Author

N73-28662*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NUCLEAR CHARACTERISTICS OF A FISSIONING URANIUM PLASMA TEST REACTOR WITH LIGHT-WATER COOLING
Charles L. Whitmarsh, Jr. Washington Aug. 1973 20 p refs (NASA-TM-X-2864; E-7455) Avail: NTIS HC $3.00 CSCL 18I

An analytical study was performed to determine a design configuration for a cavity test reactor. Test section criteria were that an average flux of 10 to the 15th power neutrons/sq cm/sec (E less than or equal to 0.12 eV) be supplied to a 61-cm-diameter spherical cavity at 200-atm pressure. Design objectives were to minimize required driver power, to use existing fuel-element technology, and to obtain fuel-element life of 10 to 100 full-power hours. Parameter calculations were made on moderator region size and material, driver fuel arrangement, control system, and structure in order to determine a feasible configuration. Although not optimized, a configuration was selected which would meet design criteria. The driver fuel region was a cylindrical annular region, one element thick, of 33 MTR-type H2O-cooled elements (Al-U fuel plate configuration), each 101 cm long. The region between the spherical test cavity and the cylindrical driver fuel region was Be (10 vol. % H2O coolant) with a midplane dimension of 8 cm. Exterior to the driver fuel, the 25-cm-thick cylindrical and axial reflectors were also Be with 10 vol. % H2O coolant. The entire reactor was contained in a 10-cm-thick steel pressure vessel, and the 200-atm cavity pressure was equalized throughout the driver reactor. Fuel-element life was 50 hr at the required driver power of 200 MW. Reactor control would be achieved with rotating poison drums located in the cylindrical reflector region. A control range of about 18 percent delta k/k was required for reactor operation. Author

N73-28663*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CALCULATED POWER DISTRIBUTION OF A THERMIONIC, BERYLLIUM OXIDE REFLECTED, FAST-SPECTRUM REACTOR
Wendell Mayo and Edward Lantz Washington Aug. 1973 17 p refs
(NASA-TM-X-2838; E-7443) Avail: NTIS HC $3.00 CSCL 18I

A procedure is developed and used to calculate the detailed power distribution in the fuel elements next to a beryllium oxide reflector of a fast-spectrum, thermionic reactor. The results of the calculations show that, although the average power density in these outer fuel elements is not far from the core average, the power density at the very edge of the fuel closest to the beryllium oxide is about 1.8 times the core avearge. Author

N73-28664# Atomics International, Canoga Park, Calif.
SNAP REACTOR PROGRAMS Progress Report, Aug. - Oct. 1972
28 Feb. 1973 209 p refs
(Contract AT(04-3)-701)
(AI-AEC-13046) Avail: NTIS

Development work during Aug. to Nov. 1972 in the SNAP Reactor Program is reported. Information is included on: (1) the conceptual design of a 5 kW(e) U-Zrh reactor; (2) core hydraulic tests, shield design, and fuel element testing; and development of PbTe thermoelectric conversion system. NSA

N73-28665# Oak Ridge National Lab., Tenn.
NUCLEAR FUSION CHAIN REACTION APPLICATIONS IN PHYSICS AND ASTROPHYSICS
J. R. McNally, Jr. 1972 15 p Presented at Symp. on Appl. of Nucl. Data in Sci. and Technol., Paris, 12 Mar. 1973
(IAEA/SM-170/49; Conf-730302-5) Avail: NTIS HC $3.00

A review of major developments in controlled fusion involving magnetic mirror machines is given. Fokker-Planck calculations of scaling laws for mirror machines are briefly discussed. Some reaction kinetics are described. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology; and 29 Space Radiation.

N73-28666 Pennsylvania State Univ., University Park.
ACOUSTIC RADIATION FROM A POINT EXCITED INFINITE ELASTIC PLATE Ph.D. Thesis
Alan Douglas Stuart 1972 188 p
Avail: Univ. Microfilms Order No. 73-7488

The acoustic pressure radiated by an infinite elastic plate excited by a dynamic point force is investigated. The effects of shear and rotary inertia in the plate have been included to insure the proper representation of the high-frequency components of the radiated pressure. The pressure radiated by this coupled plate-fluid system is obtained with the use of integral transform methods; a Hankel transform on the spatial coordinate and a Fourier (bilateral Laplace) transform on the temporal variable. Dissert. Abstr.

N73-28667 Houston Univ., Tex.
ROUGH SURFACE DOPPLER RETURN SPECTRA Ph.D. Thesis
Malkiat Singh Sohel 1972 158 p
Avail: Univ. Microfilms Order No. 73-8928

Doppler return spectra, from a two-dimensional random rough ocean surface are investigated for both radar and sonar signals. Theoretical expressions of the Doppler spectra are derived and their numerical values are calculated using a computer and an analysis of the resulting data is presented. Certain approximations in the previously reported work are removed and/or modified for the case of a one-dimensional random rough surface and the case of the two-dimensional surface is also solved. In order to develop the theoretical Doppler spectrum expressions, Kirchhoff-Huygen integral approach is used. Shadowing and multiple scattering effects are not considered. For the sonar case, a frequency of 50 KH is employed and for the radar case a frequency of 20 GH is used. Dissert. Abstr.

N73-28668 Utah Univ., Salt Lake City.
THE REMOVAL OF UNKNOWN IMAGE BLURS BY HOMOMORPHIC FILTERING Ph.D. Thesis
Edwin Randolph Cole, Jr. 1973 130 p
Avail: Univ. Microfilms Order No. 73-8148

A homomorphic method is reported for the estimation and removal of unknown image blurs, which are presumed to have been caused by a linear stationary system. The estimation method uses a homomorphic mapping to map sections of the blurred image, which is a convolutional combination of the undistorted image and the blur, into a domain (the log spectrum) in which the components corresponding to the undistorted image and blur are added. An averaging method allows the component corresponding to the undistorted image to be estimated and substracted leaving an estimated of the component corresponding to the blur. This estimate is then used to generate a homomorphically estimated restoration filter. Dissert Abstr.

N73-28669# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).

MEASUREMENTS OF ACOUSTIC ABSORPTION COEFFICIENT OF BIDIN FOR DIFFERENT DENSITIES, COMPACTING AT VARIOUS DISTANCES FROM AN INFINITE IMPEDANCE WALL, ACCORDING TO ASTM C-384/58

L. X. Nepemuceno 27 Feb. 1973 9 p In PORTUGUESE; ENGLISH summary

(TR-7302.626) Avail: NTIS HC $3.00

The materials, procedures, and results of acoustic measurements of Bidin are described. The results are presented for different densities and distances from the infinite impedance wall. .Author

N73-28670# Joint Publications Research Service, Arlington, Va.

MEASUREMENT OF DEMAGNETIZING FIELDS IN CYLINDRICAL MAGNETIC FILMS

G. M. Nurmukhamedov and G. M. Khadzhimatova 26 Jul. 1973 8 p refs Transl. into ENGLISH from Sb. Nauchn. Tr. po Probl. Mikroelektron. (Moscow, no. 9, 1972 p 68-75

(JPRS-59624) Avail: NTIS HC $3.00

A magnetooptical microanalyzer based on the Kerr equatorial effect is used for the measurement of demagnetizing fields in cylindrical magnetic films. G.G.

N73-28671*# Interand Corp., Chicago, Ill.

ACOUSTIC PROCESSING METHOD FOR MS/MS EXPERIMENTS Final Report

R. R. Whymark Jun. 1973 46 p refs

(Contract NAS8-29030)

(NASA-CR-124300; IC-726) Avail: NTIS HC $4.50 CSCL 20A

Acoustical methods in which intense sound beams can be used to control the position of objects are considered. The position control arises from the radiation force experienced when a body is placed in a sound field. A description of the special properties of intense sound fields useful for position control is followed by a discussion of the more obvious methods of position, namely the use of multiple sound beams. A new type of acoustic position control device is reported that has advantages of simplicity and reliability and utilizes only a single sound beam. Finally a description is given of an experimental single beam levitator, and the results obtained in a number of key levitation experiments. Author

N73-28672*# Michigan Univ., Ann Arbor. Radiation Lab.

ON ELECTROMAGNETIC FIELD PROBLEMS IN INHOMOGENEOUS MEDIA

A. Mohsen Jan. 1973 16 p refs

(Grant NGR-23-005-477)

(NASA-CR-132286; Rept-010106-2-T) Avail: NTIS HC $3.00 CSCL 20C

Analysis of electromagnetic fields in inhomogeneous media is of practical interest in general scattering and propagation problems and in the study of lenses. For certain types of inhomogeneities, the fields may be represented in terms of two scalars. In a general orthogonal coordinate system, these potentials satisfy second order differential equations. Exact solutions of these equations are known only for a few particular cases and in general, an approximate or numerical technique must be employed. The present work reviews and generalizes some of the main methods of attack of the problem. The results are presented in a form appropriate for numerical computation. Author

N73-28673# City Coll. of the City of New York. Dept. of Physics.

ADVENTURES IN GREEN'S LAND: LIGHT SCATTERING IN ANISOTROPIC MEDIA

M. Lax and D. F. Nelson (Bell Labs., Murray Hill, N. J.) Feb. 1973 35 p refs

(Contract N00014-72-A-0406-0003; NR Proj. 016-124)

(AD-757070; TR-2) Avail: NTIS CSCL 20/6

Since the scattering volume in a crystal in a typical brillouin scattering experiment using laser excitation is small but finite, solution of the wave equation by a Green's function technique is most convenient. Two mutally consistent approaches to this problem are presented. A far field Green's function inside the crystal is calculated. The detected power outside the crystal is then calculated from it and the surface coupling factors. Second, a far field Green's function outside the crystal is calculated for several cases. A scattered power formula valid outside the crystal, which applies to crystals of any symmetry and orientation, is then presented. (Author Modified Abstract) GRA

N73-28674# Naval Undersea Center, San Diego, Calif.

SCATTERING OF SOUND BY A VISCOELASTIC, CYLINDRICAL SHELL

D. H. Hageman and V. L. Glass May 1973 28 p refs

(AD-761618; NUC-TP-348) Avail: NTIS CSCL 20/1

The pressure in the scattered wave resulting from irradiation of an infinitely long, circularly cylindrical, thin, isotropic, viscoelastic shell by a plane, monochromatic sound wave is calculated. The shell is assumed to be freely suspended in an ideal fluid, and to enclose a second, ideal fluid. The motion of the shell is described by means of Lagrange's equations, altered so as to account for viscoelasticity. The result for the scattered wave has the form of that for the elastic case except that an expression involving elastic constants is replaced by an impedance function involving viscoelastic parameters. Author (GRA)

N73-28675# Naval Postgraduate School, Monterey, Calif.

SYMMETRY AND DEGENERACY OF CHARACTERISTIC MODES FOR CONDUCTING BODIES

Jeffrey B. Knorr Jun. 1972 35 p refs

(AD-761456; NPS-52K072061A) Avail: NTIS CSCL 20/3

The notion of symmetry groups is introduced and the representation of such groups is discussed. It is shown that the operator for the eigencurrents on a conducting body is invariant under the group of symmetry operations of the structure. The eigencurrents are shown to provide bases for the irreducible representations of the symmetry group. It is further proven that expansion of the current in terms of functions belonging to the irreducible representations of the symmetry group of the structure leads to block diagonalization of the matrix representations of the operator. Basis functions for bodies of revolution are discussed. Finally, perturbations are considered and it is argued that symmetry determines exactly the splitting of any degenerate resonances of the unperturbed conducting body. Author (GRA)

N73-28676# Wisconsin Univ., Madison. Mathematics Research Center.

POTENTIALS OF CHARGED PLATES, PART 1

J. Barkley Rosser Apr. 1973 83 p refs

(Contract DA-31-124-ARO(D)-462)

(AD-761866; MRC-TSR-1318-Pt-1) Avail: NTIS CSCL 20/3

When one has two parallel plates of equal width, the potentials resulting from them can be computed by means of elliptic integrals. This discussion provides test data for the more general algorithm of the report. In the present Part 1, the revelant theory of elliptic integrals is summarized, with especial attention to the problems of deriving numerical values. Author (GRA)

N73-28677# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXCITATION OF MULTISPAN PLATES IN A RANDOM ACOUSTICAL FIELD

B. M. Efimtsov and V. N. Moskalenko 16 May 1973 12 p refs Transl. into ENGLISH from the monograph "Problemy Nadezhnosti v Stroitelnoi Mekhanike" Jun. 1968 p 234-238

(AD-761454; FTD-HT-23-231-73) Avail: NTIS CSCL 20/1

Random vibrations of an infinite-span plate on rigid supports

during cylindrical bending is studied. It is assumed that the external pressure field is a time-space random function, stationary in time and uniform with respect to the space coordinate. Damping caused by internal friction in the material of the plate is considered. A numerical example is given. Author (GRA)

N73-28678# Federal Scientific Corp., New York.
A SYSTEM FOR SAMPLING, LABELING, AND DIGITAL RECORDING OF OPTICAL MEASUREMENT DATA Final Report
Mark R. Weiss Apr. 1973 101 p refs
(Contract F30602-71-C-0007; ARPA Order 1279)
(AD-762332; RADC-TR-73-86) Avail: NTIS CSCL 20/6

Optical measurement data generated at the Verona Test Site of RADC must be reduced in a computer to extract the desired parameters. These parameters are: angle-of-arrival, phase-structure function, modulation transfer function, and amplitude scintillation. This report describes a system which processes the raw measurement data and generates digital tape recordings suitable for input to a GE 645 computer. The system consists of two components. First is an Optical Data Processor (ODP) which reduces the dynamic range required for sampling and recording the raw data, and the storage volume required for the recordings. The second component of the system is software which was written for the PDP-8 computer at the test site. (Author Modified Abstract) GRA

N73-28679# Aerospace Corp., El Segundo, Calif. Lab. Operations.
CALORIMETRIC TRANSMISSION MEASUREMENTS THROUGH THIN CARBON FOILS FOR SPECTRAL CHARACTERIZATION OF X-RAY ENERGIES BELOW 2 keV, JANUARY - DECEMBER 1972
W. M. Craven and W. C. Burns 25 May 1973 27 p refs
(Contract F04701-72-C-0073)
(AD-761826; TR-0073(3250-30)1; SAMSO-TR-73-195) Avail: NTIS CSCL 07/4

The feasibility of spectral characterization of a pulsed source of X rays with energies below 2 keV has been demonstrated. The method is based on calorimetric measurement of X-ray transmission through carbon foils of 1-micrometer thickness. With the use of a 12-element array of calorimeters, the complete transmitted fluence profile is obtained from a single X-ray pulse. The calorimeter elements have been designed for high sensitivity, and results show that a fluence as low as 10 microcal/sq cm is detectable. A new computer code, called EXSPEC, has been used to unfold X-ray spectra from experimental transmitted fluence profiles. Author (GRA)

N73-28680# Naval Ship Research and Development Center, Bethesda, Md.
RADIATION IMPEDANCE CALCULATIONS WITH THE XWAVE COMPUTER PROGRAM
Francis M. Henderson Mar. 1973 32 p refs
(ZR0140201)
(AD-762007; NSRDC-4033) Avail: NTIS CSCL 20/1

The report describes a method for calculating the acoustic radiation impedance of a vibrating structure submerged in an infinite fluid, via the solution of an integral equation relating normal surface velocity and pressure. The numerical solution of the integral equation is accomplished through use of the acoustics radiation program XWAVE. The advantage of this approach is in its applicability to structures with arbitrary surface geometry. The method is demonstrated by a calculation of the self-acoustic radiation impedance of a uniformly vibrating ring set in a rigid prolate spheroidal baffle. Computed results are compared with existing analytic solutions. Author (GRA)

N73-28681# Perkin-Elmer Corp., Norwalk, Conn.
DIFFRACTION GRATING BEAM SAMPLING TECHNOLOGY Engineering Report, 19 Oct. 1971 - 9 Jun. 1972
James S. Harris May 1973 74 p refs
(Contract F29601-71-C-0150; AF Proj. 317J)
(AD-762306; PE-ER-11204; AFWL-TR-72-140) Avail: NTIS CSCL 20/6

Grating samples for use as laser beam sampling components were developed and tested. In addition, production techniques for these gratings were investigated. Initial evaluation test of methods of production other than the conventional ruling technique showed that etching and electropolishing techniques were not as promising as ionic polishing. Ionic polishing techniques were highly successful both on molybdenum and gold sample gratings. The grating samples were tested for scatter, absorption, microscopic surface quality and macroscopic performance, including diffraction efficiency. Comparative measurements revealed little difference in performance between ruled and ion-polished gratings; however, ionic polishing techniques were found to yield more uniform gratings at relatively lower cost. Author (GRA)

N73-28520* Southwest Research Inst., San Antonio, Tex.
ULTRASONICS
Byron E. Leonard and C. Gerald Gardner *In its* Nondestructive Testing 1973 p 27-62 refs (For availability see N73-28517 19-15)
CSCL 20A

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N73-28682# Georgia Inst. of Tech., Atlanta.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INNER SHELL IONIZATION PHENOMENA AND FUTURE APPLICATIONS, VOLUME 1
R. W. Fink, ed., S. T. Manson, ed. (Ga. State Univ.), J. M. Palms, ed. (Emory Univ.), and P. Venugopala Rao, ed. (Emory Univ.) Jan. 1973 822 p refs Conf. held at Atlanta, 17-21 Apr. 1972 Sponsored by AEC, AROD, NSF, and Intern. Union of Pure and Appl. Phys. 4 Vol.
(Conf-720404-Vol-1) Avail: NTIS

The detection of low energy electrons with conventional detectors is, in general, considerably limited by relatively high cut off energies. This restriction can be overcome with suitable windowless channel electron multipliers. Such a channeltron has been used as electron detector in a magnetic beta spectrometer. The detection efficiency of the device has been determined for electron energies E greater than 0.05 keV using an electron gun and a radioactive Am-241 source of known decay rate. Author (NSA)

N73-28683# Georgia Inst. of Tech., Atlanta.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INNER SHELL IONIZATION PHENOMENA AND FUTURE APPLICATIONS, VOLUME 2
R. W. Fink, ed., S. T. Manson, ed. (Ga. State Univ.), J. M. Palms, ed. (Emory Univ.), and P. Venugopala Rao, ed. (Emory Univ.) Jan. 1973 695 p refs Conf. held at Atlanta, 17-21 Apr. 1972 Sponsored by AEC, AROD, NSF, and Intern. Union of Pure and Appl. Phys. 4 Vol.
(Conf-720404-Vol-2) Avail: NTIS

Ultra-soft X-ray absorption data are reported. Primary electron attenuation data in this low energy region are nearly nonexistent. X-ray cross sections have been measured by both transmission and reflection; electron ionization cross sections have been measured by photoelectron spectroscopy. An important characteristic of low energy photoelectron spectroscopy is that only a few atomic layers are involved in the X-ray or electron interactions being measured. The general problem of experimentally determining ionization cross sections for the 100 to 1000 eV region is discussed. Author (GRA)

N73-28684# Georgia Inst. of Tech., Atlanta.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INNER SHELL IONIZATION PHENOMENA AND FUTURE APPLICATIONS, VOLUME 4
R. W. Fink, ed., S. T. Manson, ed. (Ga. State Univ.), J. M. Palms, ed. (Emory Univ.), and P. Venugopala Rao, ed. (Emory Univ.) Jan. 1973 204 p refs Conf. held at Atlanta, 17-21 Apr. 1972 Sponsored by AEC, AROD, NSF, and Intern. Union of

Pure and Appl. Phys. 4 Vol.
(Conf-720404-Vol-4) Avail: NTIS

Some mechanisms involving twice excited states and able to produce inversions between levels lying in the soft X-ray range are studied. The spectroscopic features of an Al plasma produced by laser bombardment are discussed. NSA

N73-28685# California Univ., Livermore. Lawrence Livermore Lab.
MICROWAVE MEASUREMENTS OF 2XII RADIAL AND LONGITUDINAL ELECTRON DENSITY PROFILES
T. C. Simonen, F. H. Coensgen, W. F. Cummins, V. A. Finlayson, A. W. Molvik, G. H. Neilson, Jr., and W. E. Nexsen, Jr. 15 Feb. 1973 25 p refs
(UCRL-51348) Avail: NTIS HC $3.25

Five microwave interferometers are used to measure radial and longitudinal electron density profiles versus time in the 2XII minimum-B mirror containment experiment. The mean plasma radius determined from a radially offset interferometer agrees with electrostatic probe and laser measurements. The longitudinal profile is consistent with a collisional ion angular distribution with a density at the mirrors of 5% of the central density. After compression, the plasma shape remains approximately constant. Plasma densities beyond the mirrors were less than 5% of the central density. Author (NSA)

N73-28686# Interuniversitair Reactor Instituut, Delft (Netherlands).
IONIZATION IN THE TRACK OF A HIGH ENERGY ELECTRON IN LIQUID CYCLOHEXANE. PULSE RADIOLYSIS OF SOLUTIONS OF BIPHENYL IN CYCLOHEXANE
A. Hummel and L. H. Luthjens 1972 42 p refs Submitted for publication
(IRI-133-72-07) Avail: NTIS HC $4.25

In order to study the ionization in the track of a high energy electron in liquid cyclohexane, the lifetime distribution of the charged species was considered, with and without solutes present that can react with the species and change their mobility. Calculations of the lifetime distributions of the ions are presented; these were made on the assumption that the precursors of the ion scavenging reactions can be considered as classically diffusing ions, initially present as pairs of oppositely charged species in each other's field. The calculations were compared with the lifetime distributions of biphenyl ions in solutions of biphenyl in cyclohexane with and without other solutes present, as determined by nanosecond pulse radiolysis. It was concluded that the precursor of the positive biphenyl ion is a positive species, considerably more mobile than a molecular ion. Author (ESRO)

N73-28687# Georgia Inst. of Tech., Atlanta.
PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INNER SHELL IONIZATION PHENOMENA AND FUTURE APPLICATIONS, VOLUME 3
R. W. Fink, ed., S. T. Manson, ed. (Ga. State Univ.), J. M. Palms, ed. (Emory Univ.), and P. Venugopala Rao, ed. (Emory Univ.) Jan. 1973 745 p refs Conf. held at Atlanta, 17-21 Apr. 1972 Sponsored by AEC, AROD, NSF, and Intern. Union of Pure and Appl. Phys. 4 Vol.
(Conf-720404-Vol-3) Avail: NTIS

A brief survey of the work on high frequency satellites in X-ray spectra is presented. Suitable transitions have been assigned to as many of the observed satellites as possible. The final assignments have been justified by comparing the experimentally observed values of the wave lengths with those obtained on the basis of Wentzel-Druyvesteyn Theory of single electron transition in atoms with multiple inner shell ionization. A new systematic nomenclature scheme for these satellites is proposed. A suggestion has been made for the compilation of two vacancy and three vacancy energy level diagrams and some graphical exposition of regularities. Author (NSA)

N73-28688# Naval Intelligence Support Center, Washington, D.C. Translation Div.
MEASURING THE OSCILLATION RELAXATION TIME OF THE 00(0)1 LEVEL OF CO2 MOLECULES IN THE TEMPERATURE INTERVAL OF 300-600 K
A. S. Biryukov, V. K. Konyukhov, A. I. Lukovnikov, V. A. Myslin, and R. I. Serikov 20 Jun. 1973 7 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), no. 2, 1972 p 249-252
(AD-762436; NISC-Trans-3447) Avail: NTIS CSCL 07/4

In a number of papers, measurements have been made of the oscillation relaxation time of CO2 at T about 300K. The temperature relationships that were of the most interest during an analysis of the kinetics of processes occurring in a CO2 laser were obtained through pulse excitation and in shock tube. In the present paper, a phase method was used to measure the relaxation time of CO2 molecules in the temperature interval of 300-600K in pure CO2 and to obtain data on the effect of 4He and N2 on the relaxation time in this temperature interval. GRA

N73-28689# National Bureau of Standards, Washington, D.C. Center for Radiation Physics.
A GAMMA RAY MOMENTS COMPUTER CODE. GAMMON-1
Charles M. Eisenhauer, George L. Simmons, and Lewis V. Spencer Apr. 1973 44 p
(AD-761839; NBS-TN-766) Avail: NTIS MF $0.95; HC SOD $0.75 as C.13.46:766 CSCL 20/8

In the paper the authors describe a computer code for generating spatial-angular moments of gamma ray energy fluence in an infinite medium. The equation for moments of the energy fluence is given and the techniques used for the solution are discussed. The structure of the code and of the main sub-routines is also given. Details of the input and output data are presented and the printout from a sample problem is included. Author (GRA)

N73-28768* Observatoire de Paris-Meudon (France).
THE DEUTERIUM PUZZLE IN THE SYMMETRIC UNIVERSE
B. Leroy, J. P. Nicolle, and E. Schatzman *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 15 p refs (For availability see N73-28753 19-29)
CSCL 20H

N73-28788* Ohio State Univ., Columbus.
GYROSYNCHROTRON RADIATION FORMULAE
H. C. Ko *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 198-206 refs Sponsored in part by AFCRL (For availability see N73-28772 19-29)
CSCL 20H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N73-28690 California Univ., Los Angeles.
DRIFT WAVES IN FINITE BETA PLASMAS Ph.D. Thesis
Morrell Sylvester Chance 1972 177 p
Avail: Univ. Microfilms Order No. 73-6380

Some finite Beta effects in theoretical calculations applicable to collisionless inhomogeneous plasmas were studied to determine the ramifications. The main interests are in the finite Beta effect of low frequency drift waves. Mathematical complications are avoided by using the high Beta work of Mikhailouskii and Rudakol (1963) which includes finite Beta effects but is still restricted to values of Beta much less than unity. The theory was adapted to a magnetospheric situation by Coroniti and Kennel (1970), but later observations showed that there were discrepancies in the predictions of this theory. Modifications of these calculations were accomplished by including high beta effects which show that observations and theory are now quite compatible. Dissert. Abstr.

N73-28691 Illinois Univ., Urbana.
MONTE CARLO SIMULATION OF NONLINEAR RADIATION INDUCED PLASMAS Ph.D. Thesis
Bejjamin Shaw-Hu Wang 1972 131 p
Avail: Univ. Microfilms Order No. 73-10078

A Monte Carlo simulation model for radiation induced plasmas with nonlinear properties due to recombination has been developed, employing a piecewise linearized predict-correct iterative technique. Several important variance reduction techniques have been developed and incorporated into the model, including an antithetic variates technique which has proven to be most useful. This approach is especially efficient for plasma systems with inhomogeneous media, multidimensions, and irregular boundaries, where other analytic or numerical solutions are either unrealistic or impractical. This model is quite general in scope and should be applicable to a variety of similar particle transport and diffusion-type plasma problems. Dissert. Abstr.

N73-28692# Nagoya Univ. (Japan). Inst. of Plasma Physics.
CHARACTERISTIC OAXILLATIONS OF A CYLINDRICAL PLASMA
J. Hatori and T. Watanabe Aug. 1972 33 p refs
(IPPJ-133) Avail: AEC Depository Libraries

A charge-neutral cylindrical plasma with radius of the order of the ion Larmor radius is considered, and eigenfrequencies are calculated for an arbitrary normalized density of up to 1000. It is found that there exist convenient modes for rf plugging and heating when frequencies are of the ioncyclotron order..
Author (NSA)

N73-28693*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERISTICS AND PERFORMANCE OF A SUPERCONDUCTING BUMPY-TORUS MAGNET FACILITY FOR PLASMA RESEARCH
J. Reece Roth, A. David Holmes, Thomas A. Keller, and Walter M. Krawczonek Washington Aug. 1973 58 p refs
(NASA-TN-D-7353; E-7225) Avail: NTIS HC $3.00 CSCL 20I

The NASA Lewis bumpy-torus facility consists of 12 superconducting coils, each 19 cm i.d. and capable of 3.0 T on its axis. The coils are equally spaced around a toroidal array with a major diameter of 1.52 m; they are mounted with the major axis of the torus vertical in a single vacuum tank 2.6 m in diameter. Tests of the facility mapped out its magnetic, cryogenic, vacuum, mechanical, and electrical performance. The design value of the maximum magnetic field on the magnetic axis, 3.0 T, was reached and exceeded. A maximum magnetic field of 3.23 T was held for a period of 60 minutes. When the coils were charged to a maximum magnetic field of 3.35 T, the coil system went normal without apparent damage or degradation of performance. Author

N73-28694# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica
EQUILIBRIUM OF A WEAKLY TOROIDAL PLASMA COLUMN SURROUNDED BY A TRKAL-FIELD
W. Schuurman Dec. 1972 10 p refs
(NP-19697) Avail: AEC Depository Libraries; HC $3.00

The toroidal shift of a weakly toroidal plasma column surrounded by a tenuous plasma in a Trkal-field and by a metal wall is calculated. Comparison is made with similar calculations for a plasma column surrounded by either a vacuum or a tenuous plasma in a magnetic field with constant pitch.
Author (NSA)

N73-28695# Max-Planck-Institut fuer Extraterrestrische Physik, Munich (West Germany).
LOW-ENERGY ELECTRON MEASUREMENTS AND SPACECRAFT POTENTIAL: VELA 5 AND VELA 6
M. D. Montgomery, S. J. Bame, and E. W. Hones 1972 33 p refs Presented at the Symp. on Photon and Particle Interactions with Surfaces and Space, Noordwijk, Netherlands, 26 Sep. 1972
(LA-DC-72-1481;Conf-720970-1) Avail: NTIS

Low energy electron measurements from 10 to 1000 eV made by plasma probes aboard the VELA satellites provide a direct measure of the spacecraft potential with respect to the surrounding plasma when this potential rises above the lowest measured energy level, and in addition, give an indirect indication when the potential is smaller. It has been found that the spacecraft potential is a strong function of the incident electron flux from the ambient plasma and, therefore, depends strongly on the region in which the measurements are made. In addition, information concerning the dependence of spacecraft potential on photocurrent was obtained from data gathered in the magnetotail and solar wind during eclipses of the sun at the spacecraft.
Author (NSA)

N73-28696# Innsbruck Univ. (Austria). Inst. fuer Theoretische Physik.
LITERATURE SURVEY ON PLASMA INSTABILITIES COVERING 1971 PUBLICATIONS. PART 2: ABSTRACTS
G. Auer, F. Cap, and P. Hukla 31 Dec. 1972 304 p refs
(UNICP-SR-95-Pt-2) Avail: AEC Depository Libraries HC $17.25

Abstracts on publications concerned with plasma instabilities are reported which were published during the calendar year 1971. The following indices are giving: (1) Name of instability-abstract number, and (2) list of all references, ordering according to periodical. NSA

N73-28697# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-fysica.
COMPARISON OF TOROIDAL SCREW PINCH EXPERIMENTS WITH ONE DIMENSIONAL MHD COMPUTER CALCULATIONS
P. C. T. VanderLaan, A. Bijsen-Vis, and W. Kooyman Dec. 1972 18 p refs Sponsored by EURATOM
(NP-19700) Avail: AEC Depository Libraries HC $3.00

The field and pitch distributions measured in a toroidal screw pinch device are compared to the field and pitch distributions calculated by means of the Culban one-dimensional MHD code. This comparison, which is made for five different programings of the applied fields, shows a fair agreement in the outside region. To derive the pitch from the measured field component it is necessary to find the location of the displaced toroidal magnetic surfaces. The origin of the low density plasma is discussed as well as the possible role of anomalous resistivity.
Author (NSA)

N73-28698# Yale Univ., New Haven, Conn.
THEORETICAL RESEARCH IN THE FUNDAMENTALS OF PLASMA PHYSICS Final Report
I. B. Berstein 1973 11 p refs
(Contract AT(11-1)-3577)
(COO-3577-4) Avail: NTIS HC $3.00

A wide variety of theoretical investigations have been carried out in fundamental plasma physics. These include: studies of absorption in cold plasmas, a comprehensive analysis of ion-wave experiments, treatment of the motion of a charged particle in an electromagnetic field, derivation of geometric optics in ideal MHD, development of a snowplow model to treat the smooth expansion of a laser-produced plasma into a confining magnetic field and the stability thereof, study of the flow of a hypersonic plasma around a spherical absorber, theory of RF fields in spatially nonuniform plasmas and theory, of electron distribution functions in weakly ionized plasmas. NSA

N73-28699# Princeton Univ., N.J. Plasma Physics Lab.
REACTOR INJECTION, DIVERSION, AND PLASMA PROFILES
R. G. Mills Jan. 1973 55 p refs
(Contract AT(11-1)-3073)
(MATT-949) Avail: NTIS HC $4.75

Three lectures given at the International School of Fusion Reactor Technology, Erice, Sicily, September 1972 are included. They include the following: (1) The problem of fuel injection, (2) design problem of divertors, and (3) temperature and density profiles of a steady state reactor. NSA

N73-28700# Japan Atomic Energy Research Inst., Tokyo. Nuclear Fusion Lab.
NUMERICAL ANALYSIS OF THE MAGNETOHYDRODYNAMIC INSTABILITIES OF CYLINDRICAL AND TOROIDAL PLASMAS BY THE FINITE ELEMENT METHOD
T. Takeda, Y. Shimomura, M. Ohta, and M. Yoshikawa Jul. 1972 44 p refs
(JAERI-M-4890) Avail: NTIS

A finite element method is proposed for stability analysis of a cylindrical current carrying plasma embedded in a strong

longitudinal magnetic field. The purpose of the present report, which supplements and is in considerable duplication with the subsequent papers, is twofold. That is, all the results obtained thus far are summarized. The procedures of analyses are then given both in detail and comprehensively, to serve as a manual for users of the computer program. Furthermore, the formulation is described for another computer program being prepared at present for stability analysis of toroidal current-carrying plasmas in general. Author (NSA)

N73-28701# Royal Inst. of Tech., Stockholm (Sweden).
EXPERIMENT AND OBSERVATION OF ISOTOPE AND ELEMENT SEPARATION IN A PLASMA WITH COSMICAL APPLICATIONS
Sjoern Bonnevier Apr. 1972 6 p refs Presented at the Symp. on the Origin of the Solar System, Nice, 3-7 Apr. 1972
(TRITA-EPP-72-27) Avail: NTIS HC $3.00

In the laboratory, strong isotope separation has been found in rotating plasmas. In the solar system only slight variation in the isotope composition of different elements is found. Exceptions from this rule are the noble gases xenon, argon and helium. It is shown that the isotope separation observed in these gases can, in principle, be caused by centrifugal forces in plasmas. The results suggest that not only nuclear processes but also plasma processes should be considered in connection with the origin of isotope and element abundance variations.
Author (ESRO)

N73-28702# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
PLASMA STREAM IN AN INHOMOGENEOUS TRANSVERSE MAGNETIC FIELD
Erik T. Karlson Mar. 1973 30 p refs
(TRITA-EPP-73-08) Avail: NTIS HC $3.50

The adiabatic motion of finite plasma streams in inhomogeneous transverse magnetic field was studied. The magnitude of the magnetic field varies only in the direction of the initial stream velocity, and the width of the stream is much smaller than the characteristic length for the variation of the magnetic field. It was shown that for a cold plasma, the stream velocity is constant and the width of the stream is inversely proportional to the magnitude of the magnetic field. The stream is not deflected. For a hot plasma, the stream velocity decreases with increasing magnetic field and, if the field is strong enough, the stream will be stopped completely. The width of the stream decreases with increasing magnetic field, but is again increased when the stream velocity becomes very low. The stream is always deflected in the direction of ion gradient drift, but the amount of deflection depends strongly on the width of the stream. ESRO

N73-28703# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DENSE PLASMA FOCUS X-RAY EMISSION: STUDIES AND APPLICATION M.S. Thesis
Alan R. Mertz Mar. 1973 64 p refs
(AD-761800; GEP/PH/73-15) Avail: NTIS CSCL 20/9

X-radiation from a region 4.0-11.0 mm above the anode of a 33kJ plasma focus device was spectrally (1.0-5.0 keV) and temporally resolved. The plasma radiation during the first compression was found to correlate with a thermal plasma bremsstrahlung radiation in the temperature range 0.3-0.6 keV in pure deuterium. Additions of 1-4% argon and other high-z gases enhanced the soft continuum and produced intense line radiation about 20 nanoseconds after the first compression. Copper-zinc line radiation and continuum resulting from an ejected metallic cloud was produced about 150 nanoseconds after the initial compression. The angular photoelectron distribution for oblique, pulsed radiation incident upon a thin foil indicated a peak emission angle of about 30 degrees to about 50 degrees from the axis of incident radiation. Author (GRA)

N73-28704# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
GAS HEATING AND VOLUME RECOMBINATION EFFECTS ON POSITIVE COLUMN EQUILIBRIA M.S. Thesis
John W. Moore Jun. 1973 79 p refs
(AF Proj. 7071)
(AD-761492; GA/PH/73-2) Avail: NTIS CSCL 20/9

A three moment model of the positive column is applied to an axisymmetric rare gas discharge at a pressure of 35 Torr and a tube radius of 1 cm. A three species fluid is considered. The ions and electrons are considered as perfect fluids and the background gas is modeled as a viscous, thermally conductive, compressible fluid. The zero'th order equilibrium equations are solved numerically for a model with gas heating and for a model with both gas heating and volume recombination. The results indicate an electron kinetic temperature gradient due to gas heating alone with temperatures of .769 ev at the axis and .497 ev at the wall for a current of 60 ma and a much smaller temperature gradient for lower currents. (Modified Author Abstract) GRA

N73-28705# New York Univ., N.Y. Dept. of Electrical Engineering and Computer Science.
EXPERIMENTAL INVESTIGATIONS OF THE GROWTH AND DECAY OF PARAMETRICALLY EXCITED ION ACOUSTIC WAVES
Lawrence A. Klein and B. R. Cheo Apr. 1973 165 p refs
(Grant AF-AFOSR-2226-72; AF Proj. 9751)
(AD-762380; TR-402-12; AFOSR-73-1047TR) Avail: NTIS CSCL 20/9

A new technique is described for experimentally determining growth and decay rates of parametrically excited ion acoustic waves in gaseous plasmas. A microwave signal acting through a Tonks-Dattner structure is the pump for the parametric process. By switching the pump power from above threshold to below, the near threshold value of the decay rate of the ion acoustic wave is determined and shown linearly related to pump power, in agreement with parametric theory. This relation is employed to calculate the damping frequency of the ion acoustic wave, a term proportional to the coupling coefficient between energy in the pump and parametrically excited waves, and the threshold power for onset of the parametric instability. (Modified Author Abstract) GRA

N73-28706# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ATTENUATION OF LONGITUDINAL ELECTROACOUSTIC WAVES IN A PLASMA Physical Sciences Research Papers
R. J. Papa and P. Lindstrom 28 Feb. 1973 29 p refs
(AF Proj. 5635)
(AD-762272; AFCRL-PSRP-538; AFCRL-TR-73-0123) Avail: NTIS CSCL 20/9

Longitudinal waves that can be readily excited in a plasma are associated with a large number of important physical applications. One of these applications includes the use of electroacoustic probes to determine the electron density in the boundary layer of re-entry flow fields. Also, the interaction of intense laser radiation with plasmas can excite longitudinal wave instabilities and produce an anomalous resistivity of a plasma. Two mechanisms responsible for the attentuation of longitudinal waves are collisionless (Landau) damping and electron-neutral collisions. The paper is devoted to an analytical study of the spatial decay of these longitudinal waves using an explicit representation for the electric field vector. (Modified Author Abstract) GRA

N73-28707# California Univ., La Jolla. Inst. of Geophysics and Planetary Physics.
A STUDY OF COLLISIONLESS PLASMA SHOCKS Final Report, 20 Jun. 1968 - 31 Aug. 1972
Ralph H. Lovberg May 1973 31 p refs
(Contract DASA01-68-C-0172; DNA Proj. NWER-HC-040)
(AD-762426; DNA-3030F) Avail: NTIS CSCL 20/9

The report discusses an experiment designed to study collisionless shock waves in an inverse pinch discharge using argon. A magnetic disturbance was generated which propagated ahead of the driving field at twice the piston speed. Measurements of the magnetic and electric field structures, electron density and temperature, as well as ion velocities revealed that the disturbance was produced by a beam of plasma moving through the ionized ambient plasma rather than by a true shock wave. Calculations of ion trajectories using measured electric fields demonstrated that the beam originated at small radii and early times, and was not the result of a steady specular reflection

from the piston field. It is concluded that the ions comprising this stream, which were collisionless relative to the ambient ions, did not couple to the background plasma even though a strong magnetic field was applied. Author (GRA)

N73-28708# Naval Research Lab., Washington, D.C.
TRITON: AN EXPERIMENT FOR STUDYING THE INTERACTION OF AN INTENSE RELATIVISTIC ELECTRON BEAM WITH A PLASMA Interim Memorandum Report
G. C. Goldenbaum Apr. 1973 40 p refs
(NRL Proj. H02-28A)
(AD-762418; NRL-MR-2586) Avail: NTIS CSCL 20/9

The TRITON experiment for the study of plasma heating by intense, relativistic electron beams is described. A 1.2 MV beam of 150 kA of electrons is injected into a 4 M long theta pinch. The rationale for the design of this experiment is discussed in terms of the existing theory of the intense beam plasma interaction. Author (GRA)

N73-28709# Ohio State Univ. Research Foundation, Columbus.
ON THE RELATION BETWEEN THE RADIATED POWER AND THE RECEIVED POWER DUE TO GYRATING ELECTRONS IN AMBIENT PLASMA
H. C. Ko and C. Chuang 8 May 1973 13 p refs
(Contract F19628-70-C-0019; AF Proj. 4643)
(AD-762319; AFCRL-TR-73-0315; SR-1) Avail: NTIS CSCL 20/9

It is shown that the rate of energy radiated per unit of solid angle and frequency interval by a gyrating electron in an ambient magnetoactive plasma is related to the rate of energy received per unit of solid angle and frequency interval by a distant observer. (Modified Author Abstract) GRA

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N73-28710* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUPERCONDUCTIVE MAGNETIC-FIELD-TRAPPING DEVICE Patent
Alvin F. Hildebrandt, Daniel D. Elleman, and Frank C. Whitmore, inventors (to NASA) Issued 3 Aug. 1965 3 p Filed 29 Nov. 1961 Sponsored by NASA
(NASA-Case-XNP-01185; US-Patent-3,198,994; US-Patent-Appl-SN-155595; US-Patent-Class-317-158) Avail: US Patent Office CSCL 20L

An apparatus which enables the establishment of a magnetic field in air that has the same intensity as the ones in ferromagnetic materials is described. The apparatus is comprised of a core of ferromagnetic material and is surrounded by a cylinder made of a material that has superconducting properties when cooled below a critical temperature. A method is provided for producing a magnetic field through the ferromagnetic core. The core can also be split and pulled apart when it is required that the center of the cavity be left empty. E.H.W.

N73-28711 Illinois Univ., Urbana.
HIGH AND LOW BIAS EFFECTS IN TUNNEL JUNCTIONS: IN PARTICULAR THE SYSTEM DYSPROSIUM-DYSPROSIUM OXIDE-LEAD Ph.D. Thesis
James Everett Robinson 1972 142 p
Avail: Univ. Microfilms Order No. 73-10035

Observation of the superconducting energy gap structure in di/dV-V plots has verified the successful fabrication of Dy-Dy oxide-Pb tunnel junctions. These junctions are characterized using tunneling spectroscopy and calculations based on various models of the junction potential. Dissert. Abstr.

N73-28712 Illinois Univ., Urbana.
HIGH-BIAS STUDIES ON METAL-INSULATOR-METAL AND METAL-INSULATOR-SEMICONDUCTOR TUNNEL JUNCTIONS Ph.D. Thesis
Steven Wade Depp 1972 122 p
Avail: Univ. Microfilms Order No. 73-9917

Tunnel junctions were fabricated on the growth oxides of both cleaved single crystal silicon and evaporated aluminum and have been studied over a wide bias range. At low biases the previously reported inelastic and self energy structure is observed while at intermediate biases tunneling into interface states is identified in p-type silicon junctions. At high biases both silicon and aluminum junctions display behavior which cannot be understood within the framework of the average potential barrier model. To explain this behavior, a model is proposed in which tunneling proceeds via the energy levels of mobile impurities in the barrier. Dissert. Abstr.

N73-28713 Minnesota Univ., Minneapolis.
NOISE IN MOSFET'S IN THE HOT ELECTRON REGIME Ph.D. Thesis
G. Gopalakrishna 1972 76 p
Avail: Univ. Microfilms Order No. 73-10558

The dependence of the minimum noise figure of the MOSFET on the channel length is investigated. The minimum noise figure of an MOSFET device is determined by the noise resistance R sub n characterizing the drain noise spectrum, the gate noise conductance g sub n characterizing the gate noise spectrum and the HF gate conductance g sub 11 of the device. The parameters R sub n, g sub n and g sub 11 of the MOSFET are evaluated in the hot electron regime which takes into account such high field effects as velocity saturation and increasing electron temperature. Dissert. Abstr.

N73-28714# Joint Publications Research Service, Arlington, Va.
IMAGE CONVERTER BASED ON MULTI-LAYER SEMICONDUCTOR-DIELECTRIC STRUCTURES
N. F. Kovtonyuk and V. G. Fadin 27 Jul. 1973 10 p refs Transl. into ENGLISH from Zh. Prikl. Spektrosk. (Minsk), v. 18, no. 1, Jan. 1973 p 127-132
(JPRS-59636) Avail: NTIS HC $3.00

An analysis of the operation of an image converter based on multilayer semiconductor-dielectric structures is reported. Author

N73-28715*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A THIN POLYMER INSULATOR FOR JOSEPHSON TUNNELING APPLICATIONS Final Report
C. M. Wilmsen Jul. 1973 38 p refs
(Grant NGR-06-002-094)
(NASA-CR-121270) Avail: NTIS HC $4.00 CSCL 20L

The use of an organic monolayer formed from a vapor as an insulating barrier for thin film Josephson junctions is considered, and the effect of an organic monolayer on the transition temperature of a thin film superconductor is investigated. Also analyzed are the geometric factors which influence Josephson junctions and Josephson junction interferometers. Author

N73-28716*# Cornell Univ., Ithaca, N.Y. Materials Science Center.
STRUCTURE AND ENHANCED SUPERCONDUCTIVITY OF EVAPORATED ALUMINUM FILMS Ph.D. Thesis
Richard Bolton Pettit Aug. 1972 144 p refs Sponsored jointly by NASA, AEC and ARPA
(NASA-CR-133450; COO-3156-53) Avail: NTIS HC $9.25 CSCL 22L

The increase in the superconducting transition temperature of evaporated aluminum films is correlated with the average grain size, lattice constant, film thickness, and other structural properties. The transition temperature was determined by fitting the resistive transition to the theory of Aslamazov and Larkin, while the average grain size was determined from the width of the (111) diffraction ring. It was found that the transition temperature is a function of the average grain size. The approximate 1/a dependence is in agreement with the theories of Harault and Garland et al., as modified by Watton. Both theories indicate that a change in the phonon spectrum at the surface of the grain is responsible for the increased transition temperature. This size dependence is also in agreement with the experiments of Watton. Of the other properties studied, it

was found that there is an oxide layer surrounding each grain.
Author (NSA)

N73-28717# Joint Inst. for Nuclear Research, Dubna (USSR).
SOME CHARACTERISTICS OF SPRAYED SUPERCONDUCTING THIN FILMS
N. I. Balalykin, Yu. V. Muratov, Yu. I. Smirnov, N. B. Rubin, and V. G. Shabratov 1972 27 p refs In RUSSIAN
(JINR-P8-6863) Avail: AEC Depository Libraries HC $3.50

The problem of preparation of multicomponent films of definite thickness on large surfaces is considered. The results of investigation of superconducting properties of thin films are presented. Author (NSA)

N73-28718# Atomic Energy of Canada Ltd., Chalk River (Ontario).
CORRELATIONS BETWEEN CRYSTAL AND SPECTROMETER PROPERTIES OF A LARGE GERMANIUM CRYSTAL
T. A. McMath and Rosemary A. Ungrin Jan. 1973 21 p refs
(AECL-4369) Avail: AEC Depository Libraries HC $3.25

A number of experiments were performed in an effect to correlate properties of a large germanium crystal with the spectrometer properties of Ge(Li) detectors made from the crystal. Measurements of the spatial variation of etch pit density, lithium drift mobility, lithium precipitation rate, and spectrometer resolution, plus height, and relative peak counting efficienty are reported. Author (NSA)

N73-28719# Naval Postgraduate School, Monterey, Calif.
STUDY OF PbTe, PbSnTe, PbSe, PbSnSe, AND Ge METAL INSULATOR SEMICONDUCTOR MIS STRUCTURES M.S. Thesis
Lawrence Michael Kost Mar. 1973 175 p refs
(AD-761510) Avail: NTIS CSCL 20/12

A thorough understanding and a well developed fabrication procedure of MIS structures are the prerequisite for charged coupled device applications. The object of this thesis is to study the narrow gap semiconductor MIS and investigate its feasibility for IR-charge coupled images applications. Two MIS studies were made. First, MIS of five lead-tin semiconductors were fabricated using E-gun evaporated 100-450A thick Al2O3 or SiO2 layers as insulators. Second, MIS of 0.05ohm-cm p-type and 40ohm-cm n-type Ge were also studied. In addition, effects of electron bombardment simulating the space environment around Jupiter on a n-channel depletion MOSFET were studied. (Modified Author Abstract) GRA

N73-28720# California Univ., Berkeley. Dept. of Mechanical Engineering.
ON A RESTRICTED NON-ISOTHERMAL THEORY OF SIMPLE MATERIALS
M. J. Crochet and P. M. Naghdi May 1973 32 p refs
(Contract N00014-69-A-0200-1008; NR Proj. 064-436)
(AD-761634; AM-73-2) Avail: NTIS CSCL 20/12

The paper deals with non-isothermal constitutive equations and related thermodynamical aspects of a restricted class of simple materials with fading memory. Special cases of the general results, pertaining to simple fluids and simple solids, are elaborated upon and comparisons are made with earlier related developments. Author (GRA)

N73-28721# Gulf Radiation Technology, San Diego, Calif.
STUDY OF THE EFFECTS OF RADIATION ON THE ELECTRICAL AND OPTICAL PROPERTIES OF HgCdTe
Joseph F. Colwell, Roland E. Leadon, Charles E. Mallon, and James E. Naber Bedford, Mass. AFCRL 30 Nov. 1972 66 p refs
(Contract F19628-72-C-0311; AF Proj. 5621)
(AD-761488; Gulf-RT-A12410; AFCRL-TR-73-0170; SR-1) Avail: NTIS CSCL 20/12

The Hall coefficient and conductivity have been measured for several samples of Hg(0.8)Cd(0.2)Te. The measurements were made as a function of temperature from about 80 to 300K both before and after irradiation by 4.5- to 5-MeV electrons up to a fluence of 8.5 x 10 to the 14th power e/sq. cm. The carrier concentration and mobilities were calculated from these measurements. The behavior of an annealed sample after the irradiation can be understood in terms of a decrease in the bandgap - i.e., by a decrease in the amount of Cd present, and by the introduction of electron donor centers. The excess carrier lifetime was measured before irradiation as a function of temperature. It decreased from 0.5 microsec at 80K to about 10 to the minus 9th power sec at 200K. This strong decrease with temperature suggests direct recombination. The photoconductivity was measured as a function of wavelength at 80K. (Modified Author Abstract) GRA

N73-28722# Case Western Reserve Univ., Cleveland, Ohio. Chemical Engineering Div.
LOW PRESSURE VAPOR GROWTH OF DIAMOND Final Technical Report, 25 Jun. 1969 - 24 Jun. 1972
John C. Angus and Nelson C. Gardner 16 Mar. 1973 54 p refs
(Contract DAHC15-69-C-0216)
(AD-761630) Avail: NTIS CSCL 20/2

Several laboratories have reported the epitaxial growth of diamond on diamond from the vapor at subatmospheric pressures. At these conditions diamond is thermodynamically metastable with respect to graphite. Two principal means of obtaining metastable diamond growth are reported: (1) the direct deposition of carbon from hydrocarbon vapors, usually methane and (2) the metal catalyzed vapor-liquid-solid (V-L-S) technique using molten transition metals as catalysts. The growth of boron doped P-type semiconducting diamond from the vapor was successfully demonstrated. The results provided further confirmation of metastable diamond growth and also substantiate the role of boron as the electrically active impurity center in semiconducting diamond. The boron also performs a catalytic function during the growth process. (Modified Author Abstract) GRA

N73-28723# Illinois Univ., Urbana. Coordinated Science Lab.
TEMPERATURE STABILITY OF CERAMIC SURFACE ACOUSTIC WAVE DEVICES
Jeffrey Thomas Pohlman May 1973 38 p refs
(Contract DAAB07-72-C-0259)
(AD-761884; R-608; UILU-ENG-73-2210) Avail: NTIS CSCL 09/1

Two methods for measuring the temperature coefficient of delay of surface acoustic waves on a ceramic substrate are presented. Temperature coefficients were measured for a conventional surface wave delay line, and a delay line employing interdigitally poled transducers. Temperature dependence of the bandwidth, center frequency, and coupling coefficient were determined for an interdigitally poled transducer fabricated on a commercially available ceramic. Author (GRA)

N73-28724# Illinois Univ., Urbana. Coordinated Science Lab.
CONVOLUTION USING THE NONLINEAR INTERACTION OF SURFACE ACOUSTIC WAVES ON BARIUM TITANATE M.S. Thesis
Lawrence Carl Hollatz Apr. 1973 45 p refs
(Contract DAAB07-72-C-0259)
(AD-761880; R-603) Avail: NTIS CSCL 20/12

The report discusses the observation of the convolution of surface acoustic waves on barium titanate, using two 12 Mhz contradirected signals. The estimated conversion losses in the signal processing were approximately 60 d beta. (Modified Author Abstract) GRA

N73-28725# Army Foreign Science and Technology Center, Charlottesville, Va.
MAGNETIC AND ELECTRICAL PROPERTIES OF FERROMAGNETIC SEMICONDUCTORS
A. A. Samokhvalov 12 Apr. 1973 26 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Uralskii Filial, Inst. Fiz. Met. (Sverdlovsk), v. 27, 1968 p 142-158
(AD-762103; FSTC-HT-23-1643-72) Avail: NTIS CSCL 20/2

Synthesis of new ferromagnetic semiconductors with given properties can be solved on the basis of detailed physical studies of the nature of magnetism and of the mechanism of the electronic conductivity of ferromagnetic semiconductors in connection with their chemical composition and crystalline structure. The basic groups of oxide compounds of 4f- and 3d-transition metals with maximum spin values were selected for the studies in this work. The oxide compounds of divalent europium which were studied

are new ferromagnetic semiconductors and dielectrics with different cyrstal structures. The ferrodielectrics which were synthesized and studies can apparently be applied in super-high frequency low-temperature and optical instruments, and also as memory elements. (Modified Author Abstract) GRA

N73-28726# Illinois Univ., Urbana. Coordinated Science Lab.
ELECTRON SCATTERING FROM A TUNGSTEN (100) CRYSTAL
David Edgar Edward, Jr. May 1972 186 p refs
(Contract DAAB07-67-C-0199)
(AD-761876; R-556; UILU-ENG-72-2217) Avail: NTIS CSCL 20/12

The elastic reflection coefficient for the specularly scattered electrons (the (0,0) diffraction beam) has been measured for electrons scattered from the (100) surface of a tungsten crystal. The measurements were made at a polar angle of 53 degrees and azimuthal angles of 0 degrees, 22.5 degrees, and 45 degrees. The measurements were made on both clean and gas covered surfaces. The secondary electron energy distribution has also been measured at the above angles for clean and gas-covered surfaces. Both loss peaks and secondary peaks have been observed. A model is discussed which provides one explanation for the experimentally observed correlation of peaks in the elastic reflection coefficient with peaks in the secondary electron energy distribution. A comparison of model predictions and experimental results is made. Author (GRA)

N73-28727# Brown Univ., Providence, R.I. Dept. of Physics.
OPTICAL STUDIES OF BONDING IN SOLIDS
Phillip J. Stiles and Jan Tauc 25 Jun. 1973 11 p refs
(Grant DA-ARO(D)-31-124-72-G204; ARPA Order 1562)
(AD-762372) Avail: NTIS CSCL 07/4

The report very briefly summarizes the authors: research in the electronic structure of solid surfaces and its influence by chemisorption. Increased attention to these questions is motivated by the desire to understand the basic processes of chemical bonding at surfaces and the need to apply this knowledge to practical use such as in catalysis. Optical absorption experiments, which have proven indispensible in understanding the electronic structure of bulk solids, have seen little application to the study of surface electronic structure. In an effort to use optical spectroscopy more fully in surface studies, the authors applied a highly sensitive reflectance technique to the study of chemisorption on clean metal surfaces in ultrahigh vacuum. GRA

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N73-28728# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A LIMIT AMPLITUDE PREDICTION FOR PRESSURE OSCILLATIONS IN T-BURNER COMBUSTORS
M. M. Ilbiricu, Richard K. Pahel, and Herman Krier May 1973 52 p refs
(AD-762153; BRL-1646) Avail: NTIS CSCL 21/9

The acoustic pressure wave observed during testing of solid propellants in the T-burner combustor is characterized by a limit amplitude as well as by temporal growth and decay exponential coefficients for the fundamental mode of oscillation. The limit amplitude gives a measure of the degree of instability to which the combustor is being subjected. Reliable predictions of limit amplitude are therefore necessary as part of a diagnostic analysis of the propellant and combustor system. The scheme presented herein gives a prediction that is in accord with observed results. It makes use of a new nonlinear dissipation mechanism, based on entropy considerations, which reduces wave growth as pressure amplitude increases. The significance of harmonic effects is also included. Author (GRA)

N73-28729# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
MEASUREMENT OF THERMAL EXPANSION IN SOLID PROPELLANTS Interim Report, Jul. 1971 - Jul. 1972
James A. McKinnis Mar. 1973 29 p refs
(AF Proj. 305910MA)
(AD-761815; AFRPL-TR-72-109) Avail: NTIS CSCL 21/9

An analysis was performed to determine the sensitivity of solid rocket motor stress (Strain) analyses to a variation in thermal coefficient of linear expansion (TCLE). For the wide range of TCLE values currently utilized in the propellant industry, the stress analysis predicted an approximately 60 percent change in the maximum inner bore strain. A laser holograph technique was therefore devised to more accurately measure propellant TCLE. The interferometric holographic technique provided an accurate (resolution in the microinches) means of measuring linear thermal expansion for small temperatures variations (1.0 to 3.6F). Irregularities resulted in the interference fringes when the temperature change was greater than 4.0F. For the limited data taken, measured TCLE values were well within the currently acceptable range, but this initial effort did not narrow this range appreciably. Author (GRA)

N73-28730# Army Coating and Chemical Lab., Aberdeen Proving Ground, Md.
DETECTION OF NITRATE TYPE IGNITION IMPROVER IN DIESEL FUEL Final Report
George G. Esposito May 1973 15 p refs
(DA Proj. 1T0-62105-A-106)
(AD-762177; CCL-3002) Avail: NTIS CSCL 21/4

The report describes a new analytical test method for the detection of additive levels of nitrate-type cetane improvers in diesel fuel. The procedure employs a high temperature saponification followed by a sensitive spot test for nitrates. The method is relatively uninvolved and it is applicable to diesel fuel containing any of the four commonly used nitrate-type ignition improvers. The proposed method is recommended as a screening test for diesel fuel inspection test procedures that are affected by the presence of cetane improvers. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N73-28731*# Boeing Commercial Airplane Co., Seattle, Wash.
INVESTIGATION OF NOISE SUPPRESSION BY SONIC INLETS FOR TURBOFAN ENGINES. VOLUME 1: PROGRAM SUMMARY
F. Klujber, J. C. Bosch, R. W. Demetrick, and W. L. Robb Jul. 1973 221 p
(Contract NAS3-15574)
(NASA-CR-121126; D6-40855-Vol-1) Avail: NTIS HC $13.25 CSCL 20A

Results of a program for sonic inlet technology development are presented. This program includes configuration and mechanical design selection of concepts, aerodynamic design description of the models, and results of test evaluation. Several sonic inlet concepts were tested and compared for aerodynamic and acoustic performance. Results of these comparative evaluations are presented. Near-field measurements were taken inside several of the inlet models. Results of these tests are discussed with respect to the effect of Mach number gradients on noise attenuation and rotor shock wave attenuation, and boundary layer effects on noise propagation. The test facilities and experimental techniques employed are described briefly. Author

N73-28732*# Boeing Commercial Airplane Co., Seattle, Wash.
INVESTIGATION OF NOISE SUPPRESSION BY SONIC INLETS FOR TURBOFAN ENGINES. VOLUME 2: APPENDIXES
F. Klujber, J. C. Bosch, R. W. Demetrick, and W. L. Robb Jul. 1973 219 p refs
(Contract NAS2-15574)

(NASA-CR-121127; D6-40855-1-Vol-2) Avail: NTIS HC $13.00 CSCL 20A
For abstract, see N73-28731

N73-28733*# Boeing Commercial Airplane Co., Seattle, Wash.
INVESTIGATION OF NOISE SUPPRESSION BY SONIC INLETS FOR TURBOFAN ENGINES. VOLUME 3: AN EXPERIMENTAL INVESTIGATION OF THE INTERNAL NOISE FIELD OF TWO AXISYMMETRIC SONIC INLET MODELS
F. Kluiber and J. Louisse Jul. 1973 261 p refs
(Contract NAS3-15574)
(NASA-CR-121128; D6-40818-Vol-3) Avail: NTIS HC $15.25 CSCL 20A
For abstract, see N73-28731

N73-28734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLIGHT INVESTIGATION OF ACOUSTIC AND THRUST CHARACTERISTICS OF SEVERAL EXHAUST NOZZLES INSTALLED ON UNDERWING NACELLES ON AN F106 AIRPLANE
Richard R. Burley, Raymond J. Karabinus, and Robert J. Freedman Washington Aug. 1973 49 p refs
(NASA-TM-X-2854; E-7319) Avail: NTIS HC $3.00 CSCL 21E

To determine flyover noise and thrust and to investigate whether flight velocity significantly affects the noise of exhaust nozzles, a series of flight tests was conducted on three different exhaust nozzles of a type suitable for supersonic transport aircraft. The tests were conducted using an F-106B aircraft modified to carry two underwing nacelles, each containing a calibrated turbojet engine. A flyover altitude of 91 meters (300 ft) and a Mach number of 0.4 provided acoustic data that were repeatable to within + or -1.5 PNdB. Flyover results showed that an auxiliary inlet ejector nozzle was the quietest of the nozzles tested; flight velocity appeared to reduce its noise.
Author

N73-28735*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLYOVER AND STATIC TESTS TO STUDY FLIGHT VELOCITY EFFECTS ON JET NOISE OF SUPPRESSED AND UNSUPPRESSED PLUG NOZZLE CONFIGURATIONS
Roger Chamberlin Washington Aug. 1973 34 p refs
(NASA-TM-X-2856; E-7186) Avail: NTIS HC $3.00 CSCL 21E

Two spoke-type suppressor plug nozzles and a basic plug nozzle were tested for noise and thrust performance. The nozzles were mounted on an underwing nacelle on an F-106B aircraft, and tests were made both statically and in flyovers at Mach 0.4 at an altitude of 91 meters (300 ft). The flight and static data were adjusted to common reference conditions so that direct comparisons could be made. The noise characteristics that these nozzles would have on a large multiengine aircraft at a 640-meter (2100-ft) sideline distance are also presented. Flight noise levels for all three nozzles were higher than static at comparable conditions; and a shift in the frequency spectra was seen from static to flight, indicating the presence of a forward velocity effect on the noise characteristics.
Author

N73-28736*# Hughes Research Labs., Malibu, Calif.
PERFORMANCE OPTIMIZED, SMALL STRUCTURALLY INTEGRATED ION THRUSTER SYSTEM
Julius Hyman, Jr. May 1973 92 p refs
(Contract NAS3-15483)
(NASA-CR-121183) Avail: NTIS HC $6.75 CSCL 21C

A 5-cm structurally integrated ion thruster has been developed for attitude control and stationkeeping of synchronous satellites. As optimized with a conventional ion extraction system, the system demonstrates a thrust T = 0.47 mlb at a beam voltage of 1600 V, total mass efficiency of 76%, and electrical efficiency of 56%. Under the subject contract effort, no significant performance change was noted for operation with two dimensional electrostatic thrust-vectoring grids. Structural integrity with the vectoring grids was demonstrated for shock (+ or - 30 G), sinusoidal (9 G), and random (19.9 G rms) accelerations. System envelope is 31.2 cm long by 13.4 cm flange bolt circle, with a mass of 9.0 Kg, including 6.8 Kg mercury propellant.
Author

N73-28737*# Rocketdyne, Canoga Park, Calif.
REGENERATIVELY COOLED ROCKET ENGINE FOR SPACE STORABLE PROPELLANTS Final Report, 1 May - 30 Dec. 1972
W. R. Wagner Jul. 1973 126 p refs
(Contract NAS7-765)
(NASA-CR-133488; R-9275) Avail: NTIS HC $8.50 CSCL 21H

Analysis, design, fabrication, and test efforts were performed for the existing OF2/B2H6 regeneratively cooled IK (4448 N) thrust chamber to illustrate simultaneous B2H6 fuel and OF2 oxidizer cooling and to provide results for a gaseous propellant condition injected into the combustion chamber. Data derived from performance, thermal and flow measurements confirmed predictions derived from previous test work and from concurrent analytical study. Development data derived from the experimental study were indicated to be sufficient to develop a preflight thrust chamber demonstrator prototype for future space mission objectives.
Author

N73-28738# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
AERODYNAMIC EFFECTS OF TIP CLEARANCE IN A LIFTING LINE IN A NON-UNIFORM FLOW
Yoshiyuki Sugiyama (Nagoya Univ.) Apr. 1973 36 p refs
Presented at the GAMM Meeting, Munich, Apr. 1973 Sponsored by Alexander-von-Humboldt Stift.
(Rept-4/1973) Avail: NTIS HC $4.00; Max-Planck-Inst. fuer Stroemungsforsch. 10.70 DM

The aerodynamic performances of a lightly loaded lifting line which lies in a nonuniform flow of a perfect fluid through a channel, and which is interfered upon by channel walls near tips of the line, were calculated. The induced velocity potential due to the lifting line or the channel walls were calculated. By applying the relation in the lifting line theory, which implies that the effective angle of attack of a blade is equal to the sum of the geometrical angle and the downwash angle, the lift of the lifting line was connected with induced velocities obtained from the velocity potentials. Expressions were derived, from which the lift and the induced drag acting on the lifting line can be calculated. The effects of tip clearances or the nonuniformity of the flow on the aerodynamic performances of the lifting line are demonstrated numerically.
ESRO

N73-28739# Thermo Electron Engineering Corp., Waltham, Mass. Research and Development Center.
DETAILED DESIGN: RANKINE CYCLE POWER SYSTEM WITH ORGANIC-BASED WORKING FLUID AND RECIPROCATING EXPANDER FOR AUTOMOBILE PROPULSION. VOLUME 1: TECHNICAL REPORT
5 May 1972 271 p
(Contract EPA-EHSH-70-102)
(PB-210836; TE-4134-71-72-Vol-1; APTD-1154) Avail: NTIS HC $3.00 CSCL 21G

The detailed, optimized design of the system including packaging of the complete system in the reference car, the 1972 Ford Galaxie is described. The results of experimental development in several critical areas are also presented. The system is designed to provide performance approximately equivalent to use of a 351 cubic inch displacement internal combustion engine in the reference car.
Author (GRA)

N73-28740# Naval Postgraduate School, Monterey, Calif.
A REVISED DESIGN CONCEPT FOR THE A-7E APPROACH POWER COMPENSATOR SYSTEM M.S. Thesis
David Haley Finney Mar. 1973 92 p refs
(AD-761764) Avail: NTIS CSCL 21/5

The present concept of automatic throttle control, as employed in Navy carrier-based aircraft, was investigated. The aircraft chosen for study was the A-7E. The powerplant was the TF41-A-2, a turbofan engine with a relatively slow throttle response in the approach power range. The effects of additional inputs to the approach power compensator were evaluated. It was shown that a considerable increase in performance could be achieved through the incorporation of longitudinal feedback.

In addition, the limitations imposed on performance by large engine lags were found to be much less severe for systems with longitudinal feedback. The modifications suggested require a redesign of the approach power compensator system currently in use by the Navy. Author (GRA)

N73-28741# Pratt and Whitney Aircraft, West Palm Beach, Fla. Florida Research and Development Center.
TURBINE ENGINE ADVANCED ACCESSORY DRIVE SYSTEM STUDY Final Report, 1 Feb. 1972 - 31 Jan. 1973
Donald C. Colvin Wright-Patterson AFB, Ohio AFAPL Jun. 1973 293 p
(Contract F33615-72-C-1170; AF Proj. 3066)
(AD-761527; PWA-FR-5540; AFAPL-TR-73-26) Avail: NTIS CSCL 21/5

Turbine engine accessory drive techniques were investigated to establish potential systems for a lightweight low profile package. The frame of reference was provided by three classes of advanced engines for the 1975 to 1980 time period: the (1) low bypass turbofan (fighter), (2) high bypass turbofan (transport), and (3) small turbofan (remote-piloted vehicle). Design study information is presented and used to establish a ranking of candidate system attractiveness against defined and weighted criteria. Conceptual design drawings, depicting a selected system for each study engine class, are provided and development recommendations are given. (Modified Author Abstract) GRA

N73-28742# Naval Postgraduate School, Monterey, Calif.
A REVISED DESIGN CONCEPT FOR THE A-7E APPROACH POWER COMPENSATOR SYSTEM M.S. Thesis
David H. Finney and Ronald A. Hess Mar. 1973 91 p refs
(AD-761458; NPS-57HE73031A) Avail: NTIS CSCL 21/5

The present concept of automatic throttle control, as employed in Navy carrier-based aircraft, was investigated. The aircraft chosen for study was the A-7E. The powerplant was the TF41-A-2, a turbofan engine with a relatively slow throttle response in the approach power range. The effects of additional inputs to the approach power compensator were evaluated. It was shown that a considerable increase in performance could be achieved through the incorporation of longitudinal feedback. In addition, the limitations imposed on performance by large engine lags were found to be much less severe for systems with longitudinal feedback. The modifications suggested require a redesign of the approach power compensator system currently in use by the Navy. Author (GRA)

N73-28743# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL STUDY OF THE COOLING SYSTEM FOR THE ROTOR OF A LOW-FLOW GAS TURBINE
E. P. Dyban, V. N. Klimenko, Yu. S. Osherov, and B. D. Bileka 21 May 1973 15 p refs Transl. into ENGLISH from Energomashivostroenie (USSR), no. 2, 1973 p 7-10
(AD-761452; FTD-HT-23-532-73) Avail: NTIS CSCL 21/5

The report describes efforts made to improve the rotor cooling system of a gas turbine. GRA

N73-28744# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE DIMENSIONAL STATIONARY THERMAL PROBLEM FOR HOLLOW COOLED NOZZLE VANES OF A GAS TURBINE
V. S. Petrovskii 21 May 1973 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Energ. (USSR), no. 6, 1971 p 76-80
(FTD Proj. T71-04-03)
(AD-761451; FTD-HT-23-490-73) Avail: NTIS CSCL 21/5

The report presents a thermal analysis of an air cooled ducted gas turbine nozzle vane. GRA

N73-28745# AiResearch Mfg. Co., Phoenix, Ariz.
HYBRID CONTROL COMPONENTS FOR TURBINE ENGINES Final Report
George B. Mattson, Trevor G. Sutton, and Wallis T. Fleming Jun. 1973 308 p refs
(Contract F33615-72-C-1541; AF Proj. 3066)
(AD-762298; Rept-73-410130; AFAPL-TR-73-48) Avail: NTIS CSCL 21/5

Two types of transducers were designed, built, and tested during this program. One is an electro-hydrofluidic transducer which converts electrical energy into a hydraulic signal; the other is a pneumatic-hydrofluidic transducer which converts a pneumatic signal into a hydraulic signal. The electro-hydrofluidic transducer employs electromagnetic effects to produce a force and motion that influence a hydraulic fluid amplifier. The movement is applied to a small pin located in the interaction region of the amplifier to cause a deflection of the power jet relative to the amplifier receivers. This device has inherently low power consumption and low hysteresis. The design of the electromagnetic structure complements these features to produce a high accuracy, low power consumption interface device. The pneumatic-hydrofluidic transducer uses the same hydraulic fluid amplifier feature, with the major difference between the units being the method of moving the amplifier pin. (Modified Author Abstract) GRA

N73-28746# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF VARIABLE PITCH IN ALIGNMENT UNITS OF A COMPRESSOR FOR REDUCING ROTOR VIBRATIONS
I. L. Meyerson, Yu. Kh. Gazaryan, and M. E. Gorodetskii 6 Jun. 1973 20 p refs Transl. into ENGLISH from Prochnost Din. Aviats. Dvigatelei (USSR), no. 5, 1969 p 102-112
(AD-762228; FTD-HT-23-339-73) Avail: NTIS CSCL 21/5

The report describes a mathematical analysis of variable pitch compressor rotor blades designed to alleviate vibration. GRA

N73-28747# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
PERFORMANCE OF THE CRYPTOSTEADY FLOW ENERGY SEPARATOR
Joseph V. Foa Jul. 1972 46 p refs
(Contract N00019-72-C-0122)
(AD-762030; TR-ES-722) Avail: NTIS CSCL 21/5

Performance equations are developed for the cryptosteady-flow energy separator in its most general form and over the widest range of operating conditions considered so far, including bearing friction or other rotor torque, and unequal discharge pressures, peripheral velocities, flow losses, prerotation velocities, and discharge angles. Equations are also developed for the proportioning of rotor nozzles in accordance with performance specifications. Convenient performance and design charts are also presented. Author (GRA)

N73-28748# Calspan Corp., Buffalo, N.Y.
INVESTIGATION OF ROTATING STALL IN AXIAL FLOW COMPRESSORS AND THE DEVELOPMENT OF A PROTOTYPE ROTATING STALL CONTROL SYSTEM Final Technical Report
Gary R. Ludwig, Joseph P. Nenni, and Rudy H. Arendt Wright-Patterson AFB, Ohio AFAPL May 1973 284 p refs
(Contract F33615-70-C-1122; AF Proj. 3066)
(AD-762297; MK-2932-A-13; AFAPL-TR-73-45) Avail: NTIS CSCL 21/5

The report summarizes the results of a three year program on rotating stall in axial flow compressors conducted at Calspan Corporation (formerly Cornell Aeronautical Laboratory). The work encompassed both experimental and theoretical investigations of rotating stall and the development of a prototype rotating stall control system. The experimental portion of the program included investigation of the effects of blade chord and solidity upon rotating stall properties and inception as well as an investigation of the effect of blade row rotation on blade row performance. In addition, an experiment to determine the stability of the flow through a blade row was conducted. A two-dimensional small-disturbance stability theory was developed to predict the inception of rotating stlal. A single blade row and two blade row version of the theory were developed. (Modified Author Abstract) GRA

N73-28749# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYNTHESIS OF MECHANISMS OF RHOMBIC DRIVES FOR MACHINES OPERATING ON THE STIRLING CYCLE
P. V. Sergeev and Ya. F. Shmerelzon 24 May 1973 12 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii,

Mashinostr. (Moscow), no. 2, 1973 p 64-67
(AD-761594; FTD-HT-23-533-73) Avail: NTIS CSCL 21/7

A method is presented for determining the structural parameters of the mechanisms of rhombic drives for machines operating on the Stirling cycle, the effectiveness of which depends significantly on the ratio of the maximum volumes of the compressor and gas-expansion cavities and the angle of phase shift of these spaces. GRA

N73-28750# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF Re, M, AND K ON THE CHARACTERISTICS OF A CENTRIFUGAL COMPRESSOR STAGE
A. B. Barenboim, V. M. Levit, and G. A. Gerner 25 May 1973 10 p refs Transl. into ENGLISH from Energomashinstroenie (Moscow), no. 2, 1973 p 20-22
(AD-761608; FTD-HT-23-531-73) Avail: NTIS CSCL 13/7

An element-by-element study of a single-stage high-pressure centrifugal compressor during operation with various gases was performed. The blading of the compressor consisted of an axiradial impeller, a vaneless diffuser, and a lateral volute chamber. The tests were conducted on a bench with a closed loop that permitted a smooth change in compressor rotation speed and gas temperature and pressure at the stage inlet. The working fluids used were nitrogen and Freon-12, -22, and -114, which differed in their molecular weights, isentropic indices, and other properties. The test results were processed considering that the compressible gases were imperfect. Author

N73-28751# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
CRYPTOSTEADY-FLOW ENERGY SEPARATION
Joseph V. Foa Oct. 1972 35 p refs
(Contract N00019-72-C-0122)
(AD-762031; TR-ES-723) Avail: NTIS CSCL 21/5

The mechanism of cryptosteady-flow energy separation is described and analyzed in its most general form, with full consideration of the effects of bearing friction or other rotor torque, and of such asymmetries as unequal discharge pressures, peripheral velocities, flow losses, prerotation velocities, and discharge angles. Equations are also developed for the proportioning of rotor nozzles in accordance with performance specifications. Author (GRA)

N73-28752# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
FURTHER CONSIDERATION ON THE DESIGN OF A FOA CRYPTOSTEADY ENERGY SEPARATOR FOR USE IN SUPERSONIC AIRCRAFT
David Sobel and Arshad Nawaz Mar. 1973 26 p refs
(Contract N00019-72-C-0122)
(AD-762032; TR-ES-7) Avail: NTIS CSCL 21/5

It is shown in the report that a fixed geometry Foa Energy Separator can satisfy the cooling requirements of the F-8U aircraft without an external heat exchanger or staged configuration. A possible solution involves a hot to cold side nozzle area ratio of 0.283, dual pre-rotation at one half the rotor speed, and regenerative precooling at the Energy Separator entrance. Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

N73-28753*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERNATIONAL SYMPOSIUM AND WORKSHOP ON GAMMA-RAY ASTROPHYSICS Invited Papers
F. W. Stecker and J. I. Trombka Jun. 1973 447 p refs Held at Greenbelt, Md., 30 Apr. - 2 May 1973
(NASA-TM-X-66279; X-641-73-180) Avail: NTIS HC $24.50
CSCL 03B

Papers presented at the International Symposium of Gamma Ray Astrophysics are summarized. Summaries include gamma, cosmic, and X-ray production, presence of antimatter in the universe, and evolution of the universe. Satellite observations of cosmic and gamma rays are discussed. For individual titles, see N73-28754 through N73-28771.

N73-28754* Wisconsin Univ., Madison. Dept. of Physics.
DIFFUSE COSMIC X-RAYS BELOW 1 keV
William L. Kraushaar *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 20 p refs (For availability see N73-28753 19-29)
(Grant NGL-50-002-044)
CSCL 03B

Measurements of low energy diffuse X-rays are discussed. Particular attention was given to the energy region below 280 eV, the carbon K edge. Spatial structure, nature of local emission, and X-ray extragalactic origin are also discussed. E.H.W.

N73-28755* American Science and Engineering, Inc., Cambridge, Mass.
THE X-RAY EMISSIVITY OF THE UNIVERSE: 2-200 keV
Daniel Schwartz and Herbert Gursky *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 44 p refs (For availability see N73-28753 19-29)
(Contract NAS8-27973)
CSCL 03B

Observational results on the diffuse X-ray background between 2 and 200 keV are reported. Data are presented as a function of the volume emissivity function B (E) (ergs/sec cu Mpc keV emitted at energy E). The prescription for this is first to establish the spectral intensity I (E) (ergs/sec sq cm ster keV) measured at the earth, second to subtract the contribution due to known, discrete sources, and third to unfold the integral equation which relates the measured intensity to the emissivity. Author

N73-28756* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MEASUREMENT AND INTERPRETATION OF THE COSMIC GAMMA-RAY SPECTRUM BETWEEN 0.3 AND 27 MeV AS OBTAINED DURING THE APOLLO MISSION
L. E. Peterson (UCSD) and J. I. Trombka *In its* Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 31 p refs (For availability see N73-28753 19-29)
CSCL 03B

An analysis was made of data collected by Apollo 15 on the total cosmic gamma ray background over the 0.3 to 27 MeV range. Sources of interference with respect to the determination of diffused gamma ray spectrum were considered. Attempts were made to correct the measured spectrum for these background effects. Author

N73-28757* Naval Research Lab., Washington, D.C.
RECENT OBSERVATIONS OF COSMIC GAMMA RAYS FROM 10 MeV TO 1 GeV
Gerald H. Share *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 44 p refs (For availability see N73-28753 19-29)
CSCL 03B

Recent observations of cosmic gamma-rays made subsequent to the discovery of energetic photons from the galactic plane are analyzed. Three main areas under current investigation are treated. They are: (1) gamma ray emission from the plane of the galaxy, with emphasis on observations made in the vicinity of the galactic center, (2) gamma ray emission from the Crab nebula and its pulsar, and (3) diffuse gamma radiation. Author

N73-28758* Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany). Inst. fuer Extraterrestrische Physik.
GAMMA-RAY ASTRONOMY RESULTS OBTAINED IN EUROPE SINCE THE IAU-SYMPOSIUM NO. 55
K. Pinkau *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 7 p refs (For availability see N73-28753 19-29)
CSCL 03B

Results of European measurements of diffuse flux and the Crab pulsar NP 0532 are updated. Author

N73-28759* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY RESULTS ON SAS-2 OBSERVATIONS OF GREATER THAN 30 MeV GAMMA RADIATION
D. A. Kniffen, C. E. Fichtel, and R. C. Hartman *In its* Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 26 p refs (For availability see N73-28753 19-29)
CSCL 03B

A description is given of the SAS-2 detector and some of the preliminary results obtained from high energy gamma radiation are given. E.H.W.

N73-28760* Smithsonian Astrophysical Observatory, Cambridge, Mass.
OBSERVATIONS OF HIGH-ENERGY GAMMA RAYS
G. G. Fazio *In* NASA. Goddard Space Flight Center Intern Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 20 p refs Prepared in cooperation with Harvard Coll. Obs., Cambridge, Mass. (For availability see N73-28753 19-29)
CSCL 03B

The application of the Cerenkov light technique to detect the intensity and direction of incident gamma ray photons above 10 to the 11th power eV is studied. E.H.W.

N73-28761* New Hampshire Univ., Durham. Dept. of Physics.
OBSERVATIONS OF GAMMA-RAY EMISSION IN SOLAR FLARES
D. J. Forrest, E. L. Chupp, A. N. Suri, and C. Reppin *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 15 p refs (For availability see N73-28753 19-29)
(Contract NAS5-11054)
CSCL 03B

The observations of gamma ray emission made from the OSO-7 satellite in connection with two solar flares in early August 1972 are reported. The details of the measurements and a preliminary interpretation of some of the observed features are given. Author

N73-28762* California Univ., Berkeley. Dept. of Physics.
THE ASTROPHYSICS OF THE DIFFUSE BACKGROUND OF X-RAYS AND GAMMA RAYS
Ramanath Cowsik *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-ray Astrophysics Jun. 1973 31 p refs (For availability see N73-28753 19-29)
(Grant NGR-05-003-376)
CSCL 03B

The origin of the diffuse X-ray and gamma ray background and some of the astrophysical implications of such radiation background are outlined. The range of energies that is of interest here extends from approximately 100 eV to approximately 10 to the 8th power eV. Author

N73-28763* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MECHANISMS FOR PRODUCTION OF THE DIFFUSE GAMMA-RAY CONTINUUM RADIATION
F. W. Stecker *In its* Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 59 p refs (For availability see N73-28753 19-29)
CSCL 03B

The production of cosmic gamma radiation from Compton interactions with low energy photons, bremsstrahlung interactions, cosmic ray induced neutral pion production, and matter-antimatter annihilation is discussed. Author

N73-28764* Academy of Sciences (USSR), Moscow. P. N. Lebeden Physical Inst.
GAMMA-RAY ASTRONOMY AND COSMIC-RAY ORIGIN THEORY
V. L. Ginzburg *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 12 p refs (For availability see N73-28753 19-29)
CSCL 03B

The assumption that cosmic rays originate from metagalactic sources is investigated. Gamma ray astronomy and its application to studying nuclear components of cosmic rays far from the earth, estimating energy density of cosmic rays, and determining magnetic field strength is also examined. E.H.W.

N73-28765* Rice Univ., Houston, Tex.
PROSPECTS FOR NUCLEAR-GAMMA-RAY ASTRONOMY
Donald D. Clayton *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 42 p refs (For availability see N73-28753 19-29)
(Grant NSF GP-18335)
CSCL 03B

An analysis was made of prospects for gamma rays coming from two sources outside the solar system: (1) radioactive decay of fresh nuclear products to explosive nucleosynthesis, and (2) scattering of low energy cosmic rays. The former should be detectable and will provide a factual base for many suppositions about the site and history of nucleosynthesis. The latter may be detectable and, if so, will probably provide factual information about high-flux regions of cosmic radiation. Author

N73-28766* Durham Univ. (England). Physics Dept.
ULTRAHIGH ENERGY GAMMA-RAYS
A. W. Strong, J. Wdowczyk, and A. W. Wolfendale *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 19 p refs Sponsored by UK Sci. Res. Council (For availability see N73-28753 19-29)
CSCL 03B

An analysis is made of the interactions of very high energy cosmic ray protons with the relict radiation in extragalactic space. Two situations are examined: gamma rays derived from neutral pions -mesons produced in collisions in a nonevolutionary situation and gamma rays from electron pairs produced at early epochs. It is shown that the ultrahigh energy gamma rays could conceivably be of high enough intensity to be detected. The flux of gamma rays from the second process is not far from the diffuse background that was reported. Author

N73-28767* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MATTER-ANTIMATTER COSMOLOGY **c30**
R. Omnes *In its* Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 22 p refs (For availability see N73-28753 19-29)
CSCL 03B

The possible existence of antimatter on a large scale in the universe is evaluated. As a starting point, an attempt was made to understand the origin of matter as being essentially analogous to the origin of backgound thermal radiation. Several theories and models are examined, with particular emphasis on nucleon-antinucleon interactions at intermediate energies. Data also cover annihilation interaction with the matter-antimatter boundary to produce the essential fluid motion known as coalescence. E.H.W.

N73-28768* Observatoire de Paris-Meudon (France).
THE DEUTERIUM PUZZLE IN THE SYMMETRIC UNIVERSE **c24**
B. Leroy, J. P. Nicolle, and E. Schatzman *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 15 p refs (For availability see N73-28753 19-29)
CSCL 20H

The examination of the experimental data concerning the reaction antiproton + He-4 yields pions + nuclei shows that the low abundance of D 2 can be explained only by assuming a low He abundance at the beginning of the radiative era. This is a completely independant confirmation of the evasion of neutrons (and antineutrons) from the emulsion before the end of the epoch where nucleogenesis might have taken place, and leads to an estimate of the size of the emulsion when T = 1 MeV. Author

N73-28769* Observatoire de Paris-Meudon (France). Dept. d'Astrophysique Fundamentale.
GAMMA-RAY BACKGROUND SPECTRUM AND ANNIHILATION RATE IN THE BARYON-SYMMETRIC BIG-BANG COSMOLOGY
J. L. Puget *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 19 p refs (For availability see N73-28753 19-29)

CSCL 03B

An attempt was made to acquire experimental information on the problem of baryon symmetry on a large cosmological scale by observing the annihilation products. Data cover absorption cross sections and background radiation due to other sources for the two main products of annihilation, gamma rays and neutrinos. Test results show that the best direct experimental test for the presence of large scale antimatter lies in the gamma ray background spectrum between 1 and 70 MeV. E.H.W.

N73-28770* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DISTORTION OF THE MICROWAVE BLACKBODY BACKGROUND RADIATION IMPLIED BY THE BARYON-SYMMETRIC COSMOLOGY OF OMNES AND THE GALAXY FORMATION THEORY OF STECKER AND PUGET

F. W. Stecker and J. L. Puget (Obs. de Paris-Meudon) *In its* Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 6 p refs (For availability see N73-28753 19-29)

CSCL 03B

Theories on the evolution of the universe are evaluated. Particular attention was given to Omnes and Stecker and Puget theories. Data cover distortion of the microwave black body background energy distribution at red shifts between 10,000 and 1,000, and black body distortion due to antimatter and annihilation reactions. E.H.W.

N73-28771* Yale Univ., New Haven, Conn.

ANTIMATTER IN THE UNIVERSE? **c30**

Gary Steigman *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 11 p refs (For availability see N73-28753 19-29)

CSCL 03B

The use of gamma rays, cosmic rays, annihilation reactions, and interstellar gas reactions to prove antimatter is present in the universe is discussed. E.H.W.

N73-28772*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HIGH ENERGY PHENOMENA ON THE SUN, SYMPOSIUM PROCEEDINGS

R. Ramaty, ed. and R. G. Stone, ed. May 1973 632 p refs Symp. held at Greenbelt, Md., 28-30 Sept. 1972

(NASA-TM-X-66290; X-693-73-193) Avail: NTIS HC $33.75

CSCL 03B

The physics of high energy interactions on the sun are considered for phenomena of solar flares, microwave and hard X-ray observations, ultraviolet and soft X-ray emissions, nuclear reactions and energetic particles from flares, magnetic field interactions, and radio emissions in the corona. For individual titles, see N73-28773 through N73-28822.

N73-28773* Stanford Univ., Calif.

MASS MOTION IN SOLAR FLARES

P. A. Sturrock *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun Symp. Proc. May 1973 p 3-11 refs (For availability see N73-28772 19-29)

(Grants NGR-05-020-272; NGR-05-020-512)

CSCL 03B

Mass motions in solar flares are considered in terms of a previously proposed model. Particle acceleration occurs during reconnection of a current sheet located at coronal heights. The downward component of the particle flux produces an impulsive hard X-ray burst and heats the upper layers of the chromosphere sufficiently to lead to explosive evaporation. Some of the evaporated gas remains trapped in newly closed magnetic field lines and is responsible for the soft thermal component of X-ray emmission. Gas which flows along open magnetic field lines subsequently forms a plasmoid which is ejected by magnetic stresses into interplanetary space and may subsequently cause a geomagnetic storm. Analysis of a highly simplified model leads to formulas for the density, temperature, and other parameters of the flare-produced plasma in terms of a length scale and mean magnetic field strength for the flare. Author

N73-28774* Imperial Coll. of Science and Technology, London (England).

ENERGETIC PARTICLES AS A SOURCE OF FLARE ENERGY

H. Elliot *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 12-18 refs (For availability see N73-28772 19-29)

CSCL 03B

It seems feasible to store the 10 to the 32nd power ergs or so of energy required for a large flare in the form of protons trapped in sunspot magnetic fields. The particles are taken to have a power spectrum in kinetic energy with an average energy per particle of approximately 10 MeV. A trigger mechanism is described whereby the particles can be rapidly dumped into the chromosphere when fast electrons are produced by Coulomb collisions and probably also through pion production by the highest energy protons. The number of electrons produced seems to be adequate to account for the radio and X-ray emission observed from flares. Author

N73-28775* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOLAR FLARE OBSERVATIONS AND SOLAR FLARE MODELS

Charles L. Hyder *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 19-25 refs (For availability see N73-28772 19-29)

CSCL 03B

Solar flare models must eventually be based on specific and detailed observations of solar flares. A good presentation of solar flare observations should help the move toward flare models that are more realistic. Detailed physical analyses of the infall-impact model for flares to a secondary role in high energy solar events show that strictly thermal infall-impact cannot lead to temperatures greater than 5 x 1 million K. One more process is needed to explain the high energy aspects of solar flares; that is, temperatures equal to or greater than 10 to the 7th power K, nonthermal X-ray and radio emissions, white light flares, high energy particles far from the sun, and gamma-ray-producing particles in the sun. Author

N73-28776* Hale Observatories, Pasadena, Calif.

OPTICAL OBSERVATIONS OF THE AUGUST 1972 FLARES

Katsuo Tanaka and Harold Zirin *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 26-51 refs (For availability see N73-28772 19-29)

(Grants NGR-57-002-071; NSF GA-24015)

CSCL 03B

The optical appearance of flares in McMath 11976 is described. The region showed complex, twisted magnetic fields from its birth on July 11, 1972. The flares occurred because of high field gradients and sheared field lines, which made transitions to lower energy field configurations possible. The H alpha emission comes mainly from intense kernels about 10,000 km across in each magnetic polarity. Good H alpha spectra measure the total H alpha flux as 2.5 x 10 to the 30 power ergs. In the 3835-A band, due to fast flashes of emission are measured at the time of the impulsive flares dumping of energetic electrons in the chromosphere. The flashes last 5 or 10 seconds and have the same energy as the 50 keV electrons. The peak of emission in H alpha from the kernels and the peak 3835-A flashes agree very well with the hard X-ray peak. The spectra show H alpha emission 12 A wide in the flash phase of the August 7 flare. There is red asymmetry but no evidence of deuterium. The observations agree well with a model in which the energy is released in a kernel with volume 2 x 10 to the 27th power cucm. Author

N73-28777* California Univ., Berkeley. Space Sciences Lab.

CHARACTERISTICS OF NONTHERMAL ELECTRONS ACCELERATED DURING THE FLASH PHASE OF SMALL SOLAR FLARES

S. R. Kane *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 55-77 refs (For availability see N73-28772 19-29)

(Contract NAS5-9094; Grant NGL-05-003-017)

CSCL 03B

Observations of impulsive hard X-rays and other flash phase emissions from small solar flares are analyzed in order to determine

the characteristics of energetic electrons accelerated during the flash phase. The electron spectrum and its time variation are deduced from a model of the X-ray source in which the electron injection is continuous, and the electron energy loss is primarily due to collisions with the ambient plasma and escape into the corona. A flare model having the following properties is proposed: (1) The acceleration region is located in the lower corona. (2) the total kinetic energy of the nonthermal electron is 10 percent of the total flare energy; (3) the nonthermal electrons (and protons) provide energy for all flash phase emissions; (4) the acceleration is a continuous process, (5) the electron spectrum continuously hardens during the increasing phase of the X-ray burst and softens during the decreasing phase; and (6) the more energetic flares do not necessarily produce a harder electron spectrum. Author

N73-28778* Nagoya Univ. (Japan). Research Inst. of Atmospherics.

STRUCTURE OF PROTON CENTERS AND ASSOCIATED NONTHERMAL BURSTS AT MICROWAVE FREQUENCIES

Shinzo Enome and Haruo Tanaka *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 78-86 refs (For availability see N73-28772 19-29)

CSCL 03B

A very broad band of electromagnetic radiation is emitted during solar flares, especially at the explosive phase. This implies that there is, in the flaring region, a large variety of plasmas with various densities and a wide range of temperatures or energies. Observational evidence on the characteristics of active regions which produced proton flares and on the structure of the associated nonthermal microwave bursts of the sun is reported. Also described is the behavior of subrelativistic electrons on the sun. Data are based on observations made with interferometers at 3 cm and 8 cm, which have the same spatial resolution of 1.1 arc/min. It takes 10 seconds and 160 seconds to complete a scan of the sun for 8 cm and 3 cm, respectively. Author

N73-28779* Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

SPECTRAL CHARACTERISTICS OF MICROWAVE BURSTS

Donald A. Guidice and John P. Castelli *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 87-103 refs (For availability see N73-28772 19-29)

CSCL 03B

Various statistical parameters of the peak flux density spectra of solar microwave bursts have been examined for 1968 to 1971 based on spectra obtained from fixed-frequency observations at 245, 606, 1415, 2695, 4995, 8800, 15400, and 35000 MHz. For bursts having a centimeter-radiation component, the great majority were found to have type C spectra in the L-band to K-band range. A small percentage had miscellaneous type spectra and another small percentage had what might be taken as thermal spectra. Even for gradual rise-and-fall bursts, often thought to be of thermal origin, less than 20 percent were found to have spectra which could be classified as thermal. The relationship between the burst spectral maximum (f sub max) and the photospheric magnetic field strength of the region associated with the burst was examined. A tendency for greater correlation at higher f sub max for stronger magnetic fields is noted; however, this is overshadowed by the overall high correlations for those regions having strong photospheric magnetic fields. Author

N73-28780* Maryland Univ., College Park.

MILLIMETER WAVELENGTH OBSERVATIONS OF SOLAR ACTIVE REGIONS

M. R. Kundu *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 104-113 refs (For availability see N73-28772 19-29)

CSCL 03B

Polarization properties of active regions at 9 mm are discussed, and the observed degree of polarization is used to obtain an estimate of chromospheric magnetic fields. Also discussed is the polarization structure at 9 mm of an active region that produced a minor flare around 1900 UT on September 28, 1971. Total power observations indicate that new regions develop, or weak regions intensify at millimeter wavelengths as a result of bursts at distant sites. The spectra of the peak flux density of moderately strong bursts observed at 9 mm show a sharp drop toward the shorter millimeter wavelengths. The weak bursts at 3.5 mm are manifest mainly as heating phenomena. Author

N73-28781* Radio and Space Research Station, Slough (England).

SOLAR MILLIMETER WAVE BURSTS

David L. Croom *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 114-123 refs (For availability see N73-28772 19-29)

CSCL 03B

During the current solar cycle there has been a considerable increase in solar burst observations in the region above 10 GHz (wavelengths less than 3 cm). These observations have shown that many major solar events have large millimeter wave components, and that the total burst radio energy is frequently concentrated in this part of the spectrum. Author

N73-28782* American Science and Engineering, Inc., Cambridge, Mass.

POSSIBLE LOW ENERGY (E LESS THAN 10 keV) NONTHERMAL X-RAY EVENTS

S. W. Kahler *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 124-131 refs (For availability see N73-28772 19-29)

CSCL 03B

A search of the 3- to 30-keV data from the proportional counter detector on the OGO-E satellite has yielded several events which may be nearly completely nonthermal in the 3 smaller than E smaller than 10 keV range. In each case an impulsive hard X-ray burst accompanied by an impulsive microwave burst was associated with a low energy X-ray burst whose profile was a simple rise and fall. The lack of a two component nature in the low energy range argues that the low energy X-ray flux is due to a single physical mechanism, in this case nonthermal bremsstrahlung from accelerated electrons. However, the spectra and time profiles are quite consistent with a thermal interpretation. Polarization measurements are probably necessary to resolve the physical origin of such bursts. Author

N73-28783* California Univ., San Diego.

THERMAL AND NONTHERMAL X-RAY BURSTS OBSERVED FROM OSO-7

L. E. Peterson, D. W. Datlowe, and D. L. McKenzie *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 132-146 refs (For availability see N73-28772 19-29)

(Contract NAS5-11081)

CSCL 03B

The solar X-ray experiment on the OSO-H observes X-rays in the 2 to 15 keV range with a proportional counter and in the 10.6 to 300 keV range with a scintillation counter. The dynamic range and instrument parameters are chosen to separate X-ray emission due to a hot thermal plasma from that due to nonthermal electron populations for a large number of X-ray events associated with small flares. Many different morphological classes have been found in the 200 or so principal events observed between October 1971 and June 1972. For events which have both a thermal and nonthermal component, an analysis is performed which shows that in not all events is it possible for the nonthermal electrons to energize the thermal plasma. Many events were observed which had no nonthermal component, at least one event which was purely power law on initiation, and several events which had a long, slow decay of the hard X-rays. Author

N73-28784* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OBSERVATION OF MeV GAMMA-RAY EVENTS DURING MAY 1967 FROM ERS-18

D. E. Gruber (Calif. Univ., San Diego), L. E. Peterson (Calif. Univ., San Diego), and J. I. Vette *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 147-161 refs (For availability see N73-28772 19-29)

(Contract F04701-68-C-0108)

CSCL 03B

Gamma ray fluxes between 25 keV and 6 MeV were observed by instruments aboard the ERS 18 during the great solar flares of May 21 and May 23, 1967. Measurements were made with a 6.35-cm-diameter by 7.65-cm long NaI scintillation counter with five differential channels between 0.25 and 6.0 MeV. Data obtained during the event at 1945 UT can be fitted by a two part, power law, differential number spectrum. One part is of spectral index 3.2 between 8 keV and 0.6 MeV, and the other is of spectral index 1.2 above 0.6 MeV. An upper limit of 0.52 photons cm/2s/1 is set for 2.23 MeV line strength for this event. In all three bursts, tentatively associated with white light flares, the MeV range fluxes declined more slowly than the 25-keV fluxes. Author

N73-28785* Columbia Univ., New York. Astrophysics Lab.
HIGH ENERGY SOLAR X-RAY POLARIMETRY
R. S. Wolff *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 162-175 refs (For availability see N73-28772 19-29)
(Grants NGR-33-008-125; AF-AFOSR-1945-70)
CSCL 03B

Evidence for the existence of a highly energetic nonthermal electron distribution in the solar atmosphere during energetic flares is reviewed. Relationships are discussed between the proposed X-ray emission processes, electron distribution, and possible X-ray polarization. A description of various techniques of measuring X-ray polarization is given, and the applicability of these methods to the problem of solar X-ray measurements is considered. An idealized polarimeter capable of obtaining the most useful data related to the energetics of solar flares is proposed, and current and projected polarization experiments are discussed. Author

N73-28786* Tokyo Univ. (Japan). Dept. of Astronomy.
THEORY OF MICROWAVE AND X-RAY EMISSION
Tatsuo Takakura *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 179-187 refs (For availability see N73-28772 19-29)
CSCL 03B

The behavior of the nonthermal electrons created at the impulsive phase of flares has been deduced from the microwave impulsive bursts and hard X-ray bursts. There is almost no doubt of the emission mechanisms that radio emissions are due to gyrosynchrotron emission and hard X-rays are collisional bremsstrahlung. However, there remain three controversial problems. One is whether the emission sources of the microwave impulsive burst and hard X-ray burst are common or not. Another is whether the injection of the nonthermal electrons into the source is impulsive or continuous. The other is the relation among the nonthermal electrons, soft X-rays, EUV flash, H alpha kernels, and white light flares. These three problems are considered. Author

N73-28787* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORY OF SOLAR MICROWAVE BURSTS
R. Ramaty *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 188-197 refs (For availability see N73-28772 19-29)
CSCL 03B

The theory of solar microwave bursts is discussed in terms of gyrosynchrotron emission and absorption in a magnetoactive plasma and other absorption processes by the background medium. Simplified formulae for all turnover frequencies are given. Above about 2 GHz the most likely absorption processes for large bursts are free-free absorption and gyrosynchrotron self-absorption. The former process is capable of producing flux densities which are flat or slowly varying functions of frequency. The latter process sets absolute upper limits on the intensities of microwave bursts, which at a given frequency, depend only on the magnetic field in the source region. Author

N73-28788* Ohio State Univ., Columbus.
GYROSYNCHROTRON RADIATION FORMULAE c24
H. C. Ko *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 198-206 refs Sponsored in part by AFCRL (For availability see N73-28772 19-29)
CSCL 20H

The wave-normal emissivity and the ray emissivity formulae for an electron moving along a helical path in a magnetoactive medium are presented. Simplified formulae for the case of an isotropic plasma are also given. Because of the helical motion of the electron, a distinction is made between the radiated power per unit solid angle and the received power per unit solid angle. The relation between these two quantities in a magnetoactive medium is shown. Results are compared with those obtained by others, and the sources of discrepancies are pointed out. Author

N73-28789* California Univ., San Diego. Dept. of Physics.
NONTHERMAL X-RAYS AND RELATED PROCESSES
H. S. Hudson *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 207-220 refs (For availability see N73-28772 19-29)
(Contract NAS8-28015)
CSCL 03B

The hard X-rays associated with solar flares represent the bremsstrahlung of nonthermal electron streams. In the initial phase of the flare, the X-rays probably come from a dense region in the chromosphere, as a consequence of precipitation from the lower corona. A gradual nonthermal X-ray burst may occur in a later phase, probably caused by the electrons responsible for the type IV burst. The bombardment of the chromosphere during the early phase of the flare releases a large amount of energy there. The energy initially goes into fast particles. These interact with the chromosphere, which expands to form the hot region observed in the corona. This hot region then provides energy for many of the main-phase flare phenomena, such as H alpha emission. A clear test of the whole picture lies in its prediction of a strong infrared excess during the flash phase. Author

N73-28790* Hale Observatories, Pasadena, Calif.
OPTICAL, HARD X-RAY, AND MICROWAVE EMISSION DURING THE IMPULSIVE PHASE OF FLARES
Joan A. Vorphal *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 221-227 refs (For availability see N73-28772 19-29)
(Contract NAS5-9094; Grants NGL-05-003-017; NGL-05-002-034; NSF GA-31587)
CSCL 03B

A study was made of the variation in hard X-radiation, H alpha, and microwave emission during the impulsive phase of solar flares. The observations showed that there is an optical impulsive component in addition to the well known hard X-ray and microwave spikes. Properties of these H alpha kernels are given. Further analysis shows that the rise time in the 20- to 32-keV X-ray spike depends on the slope in the electron spectrum when thick target theory is used. A picture of the impulsive phase is given that is consistent with observations of the three above emissions. Author

N73-28791* Harvard Coll. Observatory, Cambridge, Mass.
THE EXTREME ULTRAVIOLET SPECTRUM OF SOLAR FLARES
Robert W. Noyes *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 231-241 refs Prepared in cooperation with SAO (For availability see N73-28772 19-29)
(Contract NAS5-9274)
CSCL 03B

EUV flare observations are discussed, with particular attention to relative variations of spectral features during flares. An approximately equal enhancement of most chromospheric, transition-zone, and coronal lines indicates that thermal conduction may be important at temperatures between 100,000 and 1 million K in the flare plasma. However, enhancements sometimes appear to be somewhat larger for transition zone lines and for density sensitive lines arising from metastable levels. EUV lines characteristic of temperatures between 10,000 and 1.5 x 1 million K all show a nearly simultaneous rise in impulsive flares, coincident with the hard X-ray burst. Density increases by factors of 5 to 10 in the transition zone are inferred from emission measure increases and from line ratios for small flares. Author

N73-28792* National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.

GROUND BASED OBSERVATIONS OF EUV FLARE EMISSIONS

Richard F. Donnelly *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 242-261 refs (For availability see N73-28772 19-29)

CSCL 03B

Ground based observations have established that impulsive extreme ultraviolet (EUV) flashes occur during solar flares, in close association with hard X-ray bursts and certain impulsive portions of the optical flare. The energy flux radiated in the 10 to 1030 A wavelength range exceeds that in hard X-rays by about 10,000, and is roughly comparable to the energy flux radiated at all optical wavelengths. Current knowledge of EUV flare radiation and ground-based observations of the radiation is reviewed. Several hypotheses are proposed about the interrelation between impulsive EUV emissions and other flare radiations, their spatial location, and association with magnetic fields. Author

N73-28793* Hulburt (E. O.) Center for Space Research, Washington, D.C.

SOFT X-RAY FLARE SPECTRA

G. A. Doschek and J. F. Meekins *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 262-275 refs (For availability see N73-28772 19-29)

CSCL 03B

Large solar flares produce intense soft X-ray emission, indicating the existence of high temperature plasmas that coexist in time with the plasmas responsible for the normally observed brightenings in H alpha. The time behavior of the X-ray flux appears to roughly mimic the intensity-time behavior of the H alpha flare, insofar as start times, times of maximum flux, and approximate decay times are concerned. Soft X-ray spectra of both active regions and solar flares have been obtained by instruments flown on spacecraft such as the OSO series. The disbursing elements used were Bragg crystals, and in the 8A region the resolution is typically approximately 1200. The observed characteristics of X-ray flare spectra and spectroscopic diagnostics for determining electron temperatures, electron densities, and departures from ionization equilibrium within the soft X-ray emitting plasma are discussed. Author

N73-28794* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FURTHER RESULTS ON COOLING MECHANISMS FOR SOFT X-RAY FLARES

I. J. D. Craig (Univ. Coll., London), J. L. Culhane (Univ. Coll., London), K. J. H. Phillips, and J. F. Vesecky (Leicester Univ.) *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 276-284 refs (For availability see N73-28772 19-29)

CSCL 03B

Broadband observations of solar flare X-ray spectra have indicated the existence of plasma heated to temperatures of approximately 2 to 4 times 10 to the 7th power K. Analyses of data from the soft X-ray proportional counter spectrometer on OSO-4 of two solar events with discontinuous temperature decays show that energy loss by both radiation and conduction to the cool chromospheric regions may operate in the plasma cooling mechanisms. G.G.

N73-28795* Max-Planck-Institut fuer Physik und Astrophysik, Munich (West Germany).

SOLAR GAMMA RAY AND NEUTRON OBSERVATIONS

E. L. Chupp, D. J. Forrest (New Hampshire Univ.), and A. N. Suri (New Hampshire Univ.) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 285-300 refs (For availability see N73-28772 19-29)

(Contract NAS5-11054; Grant NGL-30-002-021)

CSCL 03B

The present status of knowledge concerning the impulsive and the continuous emission of solar gamma rays and neutrons is reviewed in the light of the recent solar activity in early August 1972. The gamma ray spectrometer on OSO-H has observed the sun continuously for most of the activity period except for occultation by the earth. In association with the 2B flare on August 4, 1972, and the 3B flare on August 7, 1972, the monitor provides evidence for solar gamma ray line emission in the energy range from 300 keV to 10 MeV. A summary of all the results available from preliminary analysis of the data is given. Author

N73-28796* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NUCLEAR GAMMA RAYS FROM SOLAR FLARES

R. Ramaty and R. E. Lingenfelter (Calif. Univ., Los Angeles) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 301-314 refs (For availability see N73-28772 19-29)

CSCL 03B

The theory of gamma ray line emission from solar flares is reviewed and revised. It is shown that the recently observed line emissions at 0.5, 2.2, 4.4, and 6.1 MeV are due to positron annihilation, deuterium deexcitation following neutron capture on hydrogen, and the deexcitation of excited states in carbon and oxygen. From the observed relative line intensities it is possible to determine the spectrum of accelerated protons in the flare region. This spectrum is found to be very similar to that of charged particles from the flare observed near earth. The total numbers of protons at the sun is deduced from the observed absolute line intensities for various interaction models. It is found that if the protons at the sun have a spectrum which is an exponential in rigidity, the total energy in protons is a few times 10 to the 28th power ergs if the gamma rays are produced by protons moving down into the sun, and about 10 to the 30th power ergs if the gamma rays are produced at the site of the acceleration. Author

N73-28797* Chicago Univ., Ill.

SOLAR FLARE ACCELERATED ISOTOPES OF HYDROGEN AND HELIUM

J. D. Anglin, W. F. Dietrich, and J. A. Simpson *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 315-340 refs (For availability see N73-28772 19-29)

(Grants NGL-14-001-006; NSF GA-28368X)

CSCL 03B

New measurements are reported of solar flare hydrogen, deuterium, tritium, helium-3, and helium-4 in the energy range approximately 10 to 50 MeV per nucleon, obtained on the IMP-4 and IMP-5 satellites. The principle results are: (1) Helium-3 has been separated clearly from helium-4 in large flares; (2) the ratio Gamma (He-3/He-4) from these events is approximately one to two orders of magnitude above probable solar atmospheric values and must be the consequence of production by high energy interactions; (3) the measured upper limits for relative abundances of H-2 and H-3 are approximately a factor ten to fifty lower than earlier values; (4) a self-consistent model leads to prompt secondary production in the chromosphere below approximately 5000 km in approximately 100 seconds by H-1 on He-4 (at rest) and He-4 on H-1 (at rest) interactions above the threshold energies of approximately 25 to 30 MeV per nucleon; and (5) a variation of at least a factor five from flare to flare is observed in Gamma (He-3/He-4). Author

N73-28798* California Inst. of Tech., Pasadena.

THE ISOTOPES OF H AND He IN SOLAR COSMIC RAYS

T. L. Garrard, E. C. Stone, and R. E. Vogt *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 341-354 refs (For availability see N73-28772 19-29)

(Contract NAS5-9312; Grant NGR-05-002-160)

CSCL 03B

The isotopic composition of H and He in solar cosmic rays has been studied by solar and galactic cosmic ray experiments on the OGO F. Averaging over 20 days of data from seven flare events during 1969, we find the ratios He-3/He-4 = 0.10 + or - 0.02, D/H smaller than 3 x 0.0001 and T/H smaller than 0.0001 in the 4 to 5 MeV/nucleon energy range. In addition, we find large variations in the relative abundance of He-3 from event to event, with a maximum ratio of He-3 /He-4 = 0.26 + or - observed during October 14-15, 1969. The relative abundance of He-3 and D during this event does not seem to be consistent with existing calculations of the nuclear interaction origin of these isotopes. Author

N73-28799* Dartmouth Coll., Hanover, N.H. Radiophysics Lab.
MAGNETIC FIELD RECONNECTION AND PARTICLE ACCELERATION
B. U. O. Sonnerup *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 357-376 refs (For availability see N73-28772 19-29)
(Grant NGR-30-001-040)
CSCL 03B

After a brief review of steady state reconnection models, the processes are discussed which place an upper limit on the reconnection rate. In many applications the requirement that the width of the diffusion region exceed the ion gyroradius leads to a severe restriction on this limit. Unless the conductivity is much less than the value given by Spitzer's formula, solar flare times may result which are too long by a factor of 1000 or more. Turbulent and gyro effects which may lead to a reduced conductivity are shown to be operative, but only for sufficiently small ratios of plasma to magnetic pressure in the inflow. Particle energization processes associated with magnetic field reconnection and particle reflection by fast shocks are considered briefly. These processes are effective as a first stage in the acceleration of charged particles, but additional multistep processes are needed to reach proton energies above a few MeV. Author

N73-28800* California Univ., Berkeley. Dept. of Physics.
COMPOSITION AND ENERGY SPECTRA OF SOLAR PARTICLES
P. B. Price *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 377-392 refs (For availability see N73-28772 19-29)
(Contract NAS9-12005; Grants NGR-05-003-376; NGL-05-003-410; Contract AT(04-3)-34)
CSCL 03B

A rather sketchy view of the sun's long-term emission of heavy particles is beginning to emerge from studies of both ancient and recent tracks in a variety of recording media. Though not in itself decisive evidence for enhanced emission of heavy solar nuclei, the presence of extremely high densities of low energy Fe tracks in the majority of lunar grains down to the greatest depth sampled (approximately 2.5 m) is quite consistent with a recurring preference for heavy particle emission over times of at least approximately 10 to the 9th power years while the lunar soil was being deposited. The strong similarity of track density profiles in grains from a variety of sources - lunar, meteoritic, and surveyor glass - suggests a long term stability in the energy distribution in flares. Author

N73-28801* Chicago Univ., Ill. Enrico Fermi Inst.
A MECHANISM FOR THE ABUNDANCE ENHANCEMENTS OF HEAVY NUCLEI IN SOLAR FLARE PARTICLE EVENTS
Brian G. Cartwright and Antonio Mogro-Campero *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 393-403 refs (For availability see N73-28772 19-29)
(Contract NAS5-9366; Grants NGL-14-001-006; NSF GA-28368X)
CSCL 03B

A mechanism is proposed to account for the recently reported abundance enhancements of heavy nuclei in solar flares. The mechanism requires two acceleration stages for its operation: First, fully stripped ions are accelerated to suprathermal energies, and subsequently, a fraction of these ions are Fermi accelerated to higher energies. It is shown that because injection into Fermi acceleration is rigidity dependent and the ions may pick up electrons during transport to the Fermi acceleration region, an enhancement of the abundances of heavy nuclei can occur. The degree of the enhancement depends on a number of factors particular to each flare, so that the degree of enhancement may be variable from flare to flare, or may be a function of time within a given flare. In some flares, conditions may be such that no enhancement would be expected. Author

N73-28802* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR COSMIC RAY MICRO-EVENTS
F. B. McDonald and M. A. VanHollebeke *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 404-417 refs (For availability see N73-28772 19-29)
CSCL 03B

It has proven useful to define a special class such that the proton flux at energies greater than 20 MeV exceed 0.0001 protons/sq cm-sec-sr-MeV. These increases are termed micro-events. An arbitrary upper limit is placed at 2 x 10 squared protons/sq cm-sec-sr-MeV. By demanding a measurable flux above 20 MeV, a better separation from corotating events is achieved and onset times can in general be determined more precisely. Over an observing period extending from May 1967 through December 1971, approximately 105 events were observed. There are several different sources of these small events. Some are produced by moderate to large solar flares near the east limb or by solar flares on the nonvisible disk of the sun. Others are produced by generally minor solar activity: typically a 1N flare, a group of type III radio bursts and a well defined X-ray burst. A significant number of this latter type are accompaned by type II radio emission. A small sample of the micro-events can be classified as scatter-free events. For these the distance traveled by the particles before their initial detection at earth is on the order of 1.5 AU and observed rise and decay times are much less than normal. Author

N73-28803* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODULATION OF SOLAR COSMIC RAYS
L. A. Fisk *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 418-426 refs (For availability see N73-28772 19-29)
CSCL 03B

Considered is whether the modulation of low energy solar cosmic ray nuclei between the sun and earth can be so extreme that the fluxes observed at 1 AU imply that the cosmic ray energy density in the solar atmosphere is comparable to the thermal energy density, and/or that the cosmic ray intensity is sufficient in the solar atmosphere to produce detectable fluxes of secondary particles such as low energy positrons. It is shown that such large modulation is compatible with observations, provided that the modulation occurs principally within a solar envelope lying within approximately 0.2 to 0.3 AU of the sun. There is, however, no compelling observational evidence to require that the modulation is this large. Author

N73-28804* Bell Telephone Labs., Inc., New York.
SOLAR FLARE ALPHA PARTICLES
L. J. Lanzerotti *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 427-438 refs (For availability see N73-28772 19-29)
CSCL 03B

Interplanetary disturbances frequently change the instantaneous values of the low energy solar flare alpha-to-proton flux ratios. The fluxes of alpha particles have been integrated over the duration of seven large solar events in order to investigate the total alpha particle fluxes observed at 1 AU resulting from the flares. The spectra of the event integrated alphas are always softer than the spectra of the event integrated protons. As a consequence, the event integrated alpha-to-proton ratios decrease slightly with increasing energy per nucleon. The He-4/H-1 ratios averaged over the seven events are found to vary in the range 1 to 10 MeV/nucleon. The value of the ratio at 1 MeV/nucleon is less than the helium-to-hydrogen abundance determined from spectroscopic studies of prominences and the chromosphere.
Author

N73-28805* California Univ., Berkeley. Space Sciences Lab.
THE RELATIONSHIP OF SOLAR FLARE ELECTRONS TO THE FLARE FLASH PHASE AND TYPE 3 RADIO BURSTS
R. P. Lin *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 439-449 refs (For availability see N73-28772 19-29)
(Contracts NAS9-10509; NAS5-11038; Grant NGL-05-003-017)
CSCL 03B

The energy spectrum and temporal behavior of the 10-100 keV solar flare electrons observed at 1 AU are interpreted in terms of: (1) The location of the acceleration region; (2) the time of acceleration and duration of the injection into the interplanetary medium; and (3) type 3 radio burst origin at the

sun and at 1 AU. For at least some and possibly the majority of electron flare events the density of the acceleration region is approximately 2 x 10 to the 9th power cm/3; the time of acceleration and release coincides to within minutes of the flash phase as indicated by the type 3 radio burst, and the duration of the release is approximately less than 3 minutes. Evidence for the origin of type 3 radio bursts in 10-100 keV electron streams is shown and discussed. Author

N73-28806* High Altitude Observatory, Boulder, Colo.
CORONAL MAGNETIC FIELDS AND ENERGETIC PARTICLES
Gordon Newkirk, Jr. *In* NASA. Goddard Space Flight Cebter High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 453-477 refs (For availability see N73-28772 19-29)
CSCL 03B

Magnetic fields in coronal and interplanetary space play a critical role in determining the propagation and storage of energetic particles from the flare site to 1 AU. It is determined how several characteristics of solar energetic particle emission are influenced by the detailed configuration of the coronal magnetic fields below 2.5R solar radius. Author

N73-28807* Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A LOWER LIMIT TO THE ALTITUDE OF CORONAL PARTICLE STORAGE REGIONS DEDUCED FROM SOLAR PROTON ENERGY SPECTRA
S. M. Krimigis *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 478-485 refs (For availability see N73-28772 19-29)
(Contract N00017-72-C-4401)
Avail: NTIS CSCL 03B

The spectrum of low energy protons observed at 1 AU following solar flares shows little or no evidence of energy degradation down to approximately 0.3 MeV. Such observations are used to set a lower limit on the altitude of hypothetical coronal particle storage regions. It is pointed out that closed coronal magnetic loop structures are observed to extend so that long-term storage of low energy protons does not take place in the immediately vicinity of the sun. It is further suggested that in the few cases where the proton spectrum appears to be degraded at low energies, the energy loss may be due to adiabatic deceleration in the expanding solar wind. The alternative of continual acceleration is suggested as a plausible substitute for the particle storage hypothesis. Author

N73-28808* New Hampshire Univ., Durham. Dept. of Physics.
CORONAL PROPAGATION OF ENERGETIC CHARGED PARTICLES
E. C. Roelof *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 486-502 refs (For availability see N73-28772 19-29)
(Contracts F19628-73-C-0070; NOAA-03-3-022-41)
CSCL 03B

A technique for estimating the equatorial connection longitude of interplanetary field lines to the corona is applied to quasi-stationary low energy solar charged particle (LESP) events to reconstruct their coronal injection profile. Comparison with synoptic charts constructed from H alpha chromospheric absorption features for solar rotation 1524 reveals that the inferred chromospheric equatorial magnetic neutral line structure strikingly orders the LESP coronal injection profiles of much greater than 0.3 MeV protons for this period (August 1967), allowing the identification of acceleration processes lasting several days and well defined coronal transport over approximately greater than 100 deg. It is also proposed that LESP observations offer a unique tool for studying the magnetic structure of the transition region from the low corona to interplanetary space. Author

N73-28809* California Univ., Riverside. Dept. of Physics.
ENERGETIC PARTICLE STORAGE ON THE SUN
G. M. Simnett *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 503-515 refs (For availability see N73-28772 19-29)
CSCL 03B

Energetic particle storage is very likely to occur on the sun provided closed field lines or other suitable trapping configurations are present in the high corona. Although the attempted correlation of 169 MHz noise storms with 300 keV electron events may be tenuous, the same cannot be said with relation to moving type 4 bursts. Therefore not only does the radio data provide evidence for magnetic arches, but it also indicates nonrelease of electrons. It is an interesting feature of solar events that although recurrent proton events are seen at 10 MeV, there is little evidence for recurrent electron events. However, it has been shown that once in a storage region where ionization losses are unimportant, loss mechanisms for electrons, either through synchrotron radiation or scattering into the sun, are much more severe than for protons. Leakage losses, on the other hand, are much greater for protons. Author

N73-28810* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR RADIO BURSTS AT KILOMETER WAVELENGTHS
R. G. Stone and Joseph Fainberg *In its* High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 519-536 refs (For availability see N73-28772 19-29)
CSCL 03B

A general survey of the characteristics of type 3 radio phenomena observed at hectometer and kilometer wavelengths is presented. A brief discussion is also included here of the relationship between type 1 meter noise storms, decametric continuum, and type 3 hectometric storms. The analysis of type 3 bursts shows how these data provide information about the average energy, dispersion, and trajectory of energetic particles, as well as about the interplanetary density scale and magnetic field configuration. A brief description of the recent observations of type 2 shock wave phenomena at kilometer wavelengths is included. The summary outlines current research as well as the direction of future observations. Author

N73-28811* Michigan Univ., Ann Arbor.
DECAY TIME OF TYPE 3 SOLAR BURSTS
Hector Alvarez and F. T. Haddock *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 P 537-539 refs (For availability see N73-28772 19-29)
CSCL 03B

Type 3 bursts were observed by the radio astronomy experiment aboard the (OGO-E). Decay times (from peak intensity to 0.37 of peak) were measured and combined with published data ranging up to about 200 MHz. Because of receiver saturation, these values are considered to be upper limits. Using Hartle and Sturrock's (1968) solar wind model, collisional decay times for distances out to 1 AU were computed. Comparison with observations reveals that the observed decay times increase with decreasing frequency but at a rate considerably slower than that expected from Coulomb collisions. By fitting power functions to the computed and observed decay times, and using the local plasma hypothesis, it is found that the ratio p of computed to observed values varies with heliocentric radial distance according to a power function p = 3r sup 0.7, assuming fundamental emission, and p = 2r sup 0.7, assuming second harmonic emission. This functional dependence is approximately valid between a few solar radii and 1 AU. Author

N73-28812* Maryland Univ., College Park. Clark Lake Radio Observatory.
ON THE DENSITY OF THE CORONA IN REGIONS OF TYPE 3 ACTIVITY
T. B. H. Kuiper *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 540-551 refs (For availability see N73-28772 19-29)
(Grants NGR-21-002-029; NSF GP-19401)
CSCL 03B

The east-west positions of 190 type 3 bursts have been measured between 30 and 65 MHz with a log-periodic array. A method is described to find the intrinsic variation of position with frequency of type 3 bursts based on the comparison of the positions of the bursts measured at any two arbitary frequencies. It is found that the variation of position with frequency agrees with the behavior expected from coronal density models. This suggests that the measured positions were not seriously affected by scattering in the corona. Knowing the functional

form of the variation of position with frequency for type 3 bursts, it is shown that the observed burst positions can be corrected for the effects of ionospheric refraction. Author

N73-28813* Martin Marietta Corp., Denver, Colo.
A STORM OF TYPE 3 BURSTS OBSERVED BY RAE-1 IN AUGUST 1968
Edward G. Howard *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 552-557 refs (For availability see N73-28772 19-29)
CSCL 03B

Curves of the number of type 3 bursts as a function of time are presented for six fixed frequencies (2.8, 1.65, 1.31, 0.995, 0.700, and 0.54 MHz). The curves peak at approximately 0500 UT August 20, 1968, and are symmetrical on both sides; The time correlates well with the CMP of the McMath Region 9597. The maximum rate of bursts is approximately 150 per hour at the higher frequency of 2.8 MHz. Over 20,000 bursts were counted during the 15-day period from August 13 to August 27 when the active region was visible to the earth. A least squares normal curve has been fitted to the observational data and calculations of variance and standard deviation are given. Author

N73-28814* High Altitude Observatory, Boulder, Colo.
TYPE 2 AND TYPE 3 BURST THEORY
Dean F. Smith *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 558-572 refs (For availability see N73-28772 19-29)
CSCL 03B

The present state of the theory of type 3 bursts is reviewed by dividing the problem into the exciting agency, radiation source, and propagation of radiation between the source and the observer. In-situ measurements indicate that the excitors are electron streams of energy about 40 KeV which are continuously relaxing. A theory which takes into account both Landau damping by the background plasma and the stream itself, both of which are important at low frequencies (approximately 500 KHz) does not exist. An investigation of neutralization of an electron stream indicates that n sub s much smaller than 0.00001 n sub e, where n sub s is the stream density and n sub e the coronal electron density. In situ observations are consistent with this result. It is concluded that the whole question of inferring densities from type 3 bursts needs to be reexamined taking into account dominant second harmonics near the limb at high frequencies, dominant second harmonics everywhere at low frequencies and scattering. The present state of the theory of type 2 bursts is reviewed in the same manner as type 3 bursts. Author

N73-28815* Tokyo Univ. (Japan). Dept. of Astronomy.
TIME PROFILE OF TYPE 3 BURSTS IN DECAMETER AND HECTOMETER RANGE
Tasuo Takakura and Yoshiharu Naito *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 573-576 (For availability see N73-28772 19-29)
CSCL 03B

It is quite suspicious that the decay time of type 3 bursts at low frequencies is ascribed to the collisional damping time of plasma waves excited by a beam of fast electrons. Proposed is the following new hypothesis: The decay time of plasma waves is much shorter than the time scale of type bursts especially at low frequencies. Accordingly, the time variation of radio flux at a given frequency merely corresponds to the flux of fast electrons passing through the corresponding plasma layer. Author

N73-28816* Tokyo Astronomical Observatory (Japan).
FLARE INDUCED MHD DISTURBANCES IN THE CORONA: MORETON WAVES AND TYPE 2 SHOCKS
Yutaka Uchida (High Altitude Obs.) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 577-588 refs (For availability see N73-28772 19-29)
CSCL 03B

The propagation in the corona of the magnetohydrodynamic disturbance possibly emitted at the explosive stage in the initial phase of a flare is considered. The behavior of the MHD fast mode wavefront, whose source is located at the flare, is calculated by using eiconal characteristic method in the realistic modles of coronal magnetic field and density for the days of some particular flare events. It is shown as the result that the peculiar behavior of Moreton's surface wave and the peculiar appearance in the shape and position of the type 2 burst sources can be consistently understood by considering the refraction, focussing, and formation of shocks of MHD fast mode disturbance in the actual distribution of Alfven velocity in the corona. Based on some comparison of the positions of low Alfven velocity regions in the corona with observed positions of type 2 burst sources, it is proposed that the type 2 burst sources may be identified with such low Alfven velocity regions illuminated by thus enhanced shocks. Author

N73-28817* Commonwealth Scientific and Industrial Research Organization, Sydney (Australia).
REGULAR PULSATIONS FROM THE SOLAR CORONA
J. P. Wild *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 589-593 refs (For availability see N73-28772 19-29)
CSCL 03B

The properties of coronal pulsation events are summarized as follows: (1) Their dynamic spectrum shows that the pulses occur practically simultaneously over a frequency range typically of 2:1. Their centre frequency usually lies in the band 100 to 300 MHz; (2) individual pulse shapes are often spiky and sometimes of sawtooth shape with slow rise and fast fall, and (3) the pulse train may begin as a series of emission peaks or may develop as an apparent modulation of an existing continuum. They occur as a feature of a small proportion of type 4 bursts and during the late part of a type 2 burst when the fundamental band has drifted down to a frequency of about 15 to 30 MHz. Their occurrence shows a suggestive correlation with proton flares. Author

N73-28818* Los Alamos Scientific Lab., N.Mex.
THE POSITION AND SIZE OF RADIO SOURCES ASSOCIATED WITH SOLAR ELECTRON EVENTS c07
I. D. Palmer and R. P. Lin (Calif. Univ., Berkeley) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 594-601 refs Sponsored in part by AEC (For availability see N73-28772 19-29)
(Grant NGL-05-003-017)
CSCL 20N

The positions and sizes of the sources of type 3 bursts which are associated with interplanetary electron events are observed by a 80-MHz radioheliograph. The sizes of the responsible electron streams at 0.6 R solar radius in the corona are much smaller than the cones of propagation of the electrons in interplanetary space. Many of the type 3 bursts are shown to be accompanied by a type 5 continuum, and it is argued that the observation of a type 3 to 5 radio burst implies an increased spreading of electrons at heights greater than 0.6 R solar radius, consistent with the extent of the propagation cone of the electrons in interplanetary space. Author

N73-28819* Observatoire de Paris-Meudon (France).
HIGH SENSITIVITY SPECTRAL OBSERVATIONS IN THE DECAMETRIC RANGE
Jerome DelaNoe, Andre Boischot, and Monique Aubier *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 602-609 refs (For availability see N73-28772 19-29)
CSCL 03B

High resolution dynamic spectra of solar emissions are obtained in the range 80 to 20 MHz. It is concluded that the decametric range there are two classes of type bursts: (1) The first class regroups type 3 bursts which are generally intense, isolated, or in small groups, and correlates them with type 3 bursts in the metric range. These bursts occur at the time of flares of small as well as large importance; (2) the second class concerns storm type 3 bursts observed during the decametric storms. They are only accompanied by the 1 burst in the metric range. These storm type 3 bursts are not correlated with flares. The main feature of storm type 3 bursts is their starting frequency located between 100 and 40 MHz, generally closed to the low frequency cutoff of the related type 1 noise storms. Author

N73-28820* Observatoire de Paris-Meudon (France).
A HIGH RESOLUTION STUDY IN TIME, POSITION, INTENSITY, AND FREQUENCY OF A RADIO EVENT ON 4 JANUARY 1971
C. Caroubalos, M. Pick, H. Rosenberg (Sterrewach Sonnenborgh), and C. Slottje (Netherlands Found. of Radio Astronomy) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 610-614 refs (For availability see N73-28772 19-29)
CSCL 03B

High resolution position and spectrum measurements have been made of a complex solar radio activity on January 14, 1971, from 1120 to 1130 UT. Positions were measured with 169 MHz E-W Radioheliograph, while dynamic spectra and polarization were observed with 60-channel radiospectrograph. The radio event consisted of two closely similar groups of type 3 bursts and type 2 like details, and a stationary type 4 continuum, including some very clear pulsating structures. Author

N73-28821* Commissariat a l'Energie Atomique, Saclay (France).
THE CHROMOSPHERIC ASSOCIATION OF THE METRIC TYPE 3 BURSTS: IMPLICATIONS CONCERNING THE ACCELERATION OF SOLAR ELECTRONS AND THE ACTIVE STREAMERS
F. Axisa, M. J. Marttres (Obs. de Paris-Meudon), M. Pick (Obs. de Paris-Meudon), and I. Soru-Escaut (Obs. de Paris-Meudon) *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 615-622 refs (For availability see N73-28772 19-29)
CSCL 03B

It is shown that the metric type 3 emission is closely related to a transient perturbation seen in absorption in the H alpha line. In addition, this perturbation sometimes triggers a flare, sometimes not. This can explain why the type 3 have a poor H alpha flare correlation rate and still are a typical flash phase emission when flare-associated. Summarized are the characteristics of the new association proposed. It is assumed that 10 to 100 keV electrons are accelerated in connection with a particular kind of transient H alpha absorbing feature. This process often, but not always, results in a more efficient acceleration coincident with the early phase of the optical flare. The possibilities that this process could lead occasionally to long lasting subrelativistic particle emissive region are explored. On the other hand, the region where the acceleration takes place is certainly connected to a coronal streamer, at least when a type 3 emsission is observed. Observations indicate that a coronal streamer also exists above H2 = 0 lines which are not materialized by a stable filament. Author

N73-28822* Colorado Univ., Boulder. Dept. of Astro-Geophysics.
SYMPOSIUM ON HIGH ENERGY SOLAR PHENOMENA: SUMMARY AND OUTLOOK
James W. Warwick *In* NASA. Goddard Space Flight Center High Energy Phenomena on the Sun, Symp. Proc. May 1973 p 625-630 (For availability see N73-28772 19-29)
CSCL 03B

Solar physics aspects considered are: Optical and particle phenomenology, both in advanced stages of sophistication; plasma turbulence; nuclear energy level structure and transition probabilities; radiative transfer; and particle energy gains and losses in the chromosphere and the corona - with and without complications of anisotropy. Author

N73-28823# National Environmental Satellite Service, Washington, D.C.
REVIEW OF SATELLITE MEASUREMENTS OF ALBEDO AND OUTGOING LONG-WAVE RADIATION
Arnold Gruber Jul. 1973 13 p refs
(NOAA-TM-NESS-48) Avail: NTIS HC $3.00

Satellite measurements of albedo and outgoing long-wave radiation were reviewed. Zonal, hemispherical, and global averages for periods ranging from 15 days to several years were emphasized. Differences in results obtained from different satellites and years, as well as differences in results between investigators using the same satellite data, are discussed. Possible reasons for the differences are variable data reduction procedures, differences in satellite sensors, variable sampling in space and time, and real year-to-year variability. Author

N73-28824*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSES OF THE GAMMA-RAY PULSE-HEIGHT SPECTRA FROM THE LUNAR SURFACE
Jacob I. Trombka Jun. 1973 20 p refs
(NASA-TM-X-70421; X-641-73-167) Avail: NTIS HC $3.00
CSCL 03B

The method of inferring photon spectra from an analysis of the measured pulse-height spectrum is considered along with the spectrum shape and its variation energy. The case is examined where photoelastic absorption predominates, and Compton scattering and pair production are negligible. The analytic method for obtaining the elemental composition from the observed lunar surface spectrum is described, and theoretical and calculated weight fraction fluxes for average lunar composition are tabulated. F.O.S.

N73-28825*# Scripta Technica, Inc., Washington, D.C.
THE MEASUREMENT OF RADIATION IN SPACE
Yu. I. Galperin, L. S. Gorn, and B. I. Khazanov NASA Jul. 1973 333 p refs Transl. into ENGLISH of "Izmereniye Radiatsii v Kosmose" Moscow, Atom Press, 1972 344 p
(Contract NASw-2484)
(NASA-TT-F-754) Avail: NTIS HC $6.00 CSCL 03B

The basic problems are examined of measuring ionizing radiation in near-earth space. The results of study of the radiation fluxes in space are reviewed. Methods are examined of detecting electron, electromagnetic radiation, neutrons with energies up to 10 MeV and heavy charged particles with energies up to 1 GeV. The design of electronic measuring equipment, including equipment for the reduction and compression of data is discussed. Author

N73-28826*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE LARGE SCALE STRUCTURE OF THE SOLAR WIND
John H. Wolfe Mar. 1971 100 p refs Presented at the Solar Wind Conf., Pacific Grove, Calif., 21-26 Mar. 1971
(NASA-TM-X-69342) Avail: NTIS HC $7.00 CSCL 03B

The solar wind structure is reviewed based on experimental space measurements acquired over approximately the last decade. The character of the interplanetary medium is considered from the viewpoint of the temporal behavior of the solar wind over increasingly longer time intervals, the average properties of the various solar wind parameters and their interrelationships. A brief discussion is included of interplanetary-terrestrial relationships and the expected effects of heliographic latitude and radial distance. Author

N73-28827# King's Coll., London (England). Dept. of Mathematics.
A SELF CONSISTENT THEORY OF TRIGGERED VLF EMISSIONS
David Nunn 1973 92 p refs Sponsored by Sci. Res. Council
Avail: NTIS HC $6.75

A study was made of the nonlinear interaction of cyclotron resonant electrons with a narrow band whistler wave travelling along a magnetospheric duct. The nonlinear equations of motion were investigated and it was found that resonant electrons become stably trapped in the wave, and, because of the magnetic field inhomogeneity, such particles undergo a steady change in energy and magnetic moment. A self-consistent computer program, which follows in detail the time development of a morse pulse as it crosses the equator, was constructed. With a suitable choice of parameters it was found that the model produced long emissions of rising frequency very similar in appearance to those in reality. Although the self-consistent program suffers from an inability to handle large amplitude sideband waves, and has to be heavily smoothed, the results show convincingly that the nonlinear trapping of electrons in an inhomogenuous medium is fully able to account for triggering instability. ESRO

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N73-28828 Princeton Univ., N.J.
ON IONIZATION ZONE INSTABILITY AS THE CAUSE OF PLANETARY NEBULAE Ph.D. Thesis
Eugene Howard Scott, III 1972 46 p
Avail: Univ. Microfilms Order No. 73-9644

In order to theoretically approach the problem of the origin of planetary nebulae, a mass-loss process was simulated using a quasi-static series of models in hydrostatic equilibrium. Two types of model series were constructed: one constraining the star to adjust itself adiabatically after mass removal, and the other allowing it to adjust itself to thermal equilibrium. Tests of the stability against adiabatic perturbations were carried out for each of these series. It is shown that the thermal equilibrium case is the more physically preferred description of the mass-loss process. The mass-loss continues until all but a fraction of one percent of the star's envelope is stripped off. Investigation of the nonadiabatic stability of the star shows that the star behaves in a quite different manner than it does with respect to adiabatic perturbations. Dissert. Abstr.

N73-28829 Princeton Univ., N.J.
A MEASUREMENT OF THE MASS TO LIGHT RATIO OF THE COMA CLUSTER OF GALAXIES Ph.D. Thesis
Vincent P. Ruddy 1972 111 p
Avail: Univ. Microfilms Order No. 73-9642

The luminosity distribution of the Coma Cluster of Galaxies was measured photometrically in an effort to reconcile the abnormally high mass-to-light ratio of the cluster with that of individual galaxies. It was found that; (1) the matter was more centrally concentrated and (2) the overall luminosity was over twice as high as previously accepted. Both factors reduced the mass-to-light ratio to approximately 100, a figure which is near the upper limit of the mass-to-light ratio of individual E and SO galaxies published recently by the Burbidges (1972).
Dissert. Abstr.

N73-28830 Oklahoma Univ., Norman.
ON SPIRAL OR FLAT ELLIPTICAL GALAXIES AS GRAVITATIONAL LENSES Ph.D. Thesis
Tom Dent Norton, Jr. 1972 86 p
Avail: Univ. Microfilms Order No. 73-9165

Flat circular plates of a particular mass density are used to represent spiral or flat elliptical galaxies. The light bending formulae for such objects are found by assuming that the linearized Einstein theory of general relativity is applicable. The probability of seeing two images of a distant source around one of these objects is then examined and is found to depend upon the intrinsic properties of the galaxy, the orientation of the galaxy with respect to the observer, and upon the overall structure of the universe. The probability of observing double sources is found to be negligible in a Friedmann cosmological model with a mean mass density corresponding to that of the observed galaxies. In a model with a mean mass density just sufficient to close the universe, as many as 5 percent of the sources at redshift, two, may exhibit double images. Dissert. Abstr.

N73-28831 Minnesota Univ., Minneapolis.
MEASUREMENTS OF INFRARED RADIATION FROM MERCURY AND THE MOON Ph.D. Thesis
Thomas Lee Murdock 1972 112 p
Avail: Univ. Microfilms Order No. 73-10611

The 2.3 to 18 micron infrared radiation from the planet Mercury and the 2.3 to 8.6 micron infrared radiation from the Moon studies are presented. Experimental results are compared with predictions based on a smooth spherical black body model and it is found that neither object radiates like the model and, although they are not identical, Mercury and the Moon are quite similar. Dissert. Abstr.

N73-28832 Princeton Univ., N.J.
A MULTIVARIABLE APPROACH TO PERTURBED AEROSPACE VEHICLE MOTION Ph.D. Thesis
Paulus Theodorus Leonard Maria VanWoerkom 1972 294 p
Avail: Univ. Microfilms Order No. 73-9656

Uniformly valid, asymptotic, approximate solutions to nonlinear, ordinary differential equations containing a small parameter are developed. Systematic use is made of the multi variable approach. This method is based on the method of extension, involving extension of the independent variable into a multi dimensional domain of generally nonlinear, independent clocks, and extension of the dependent variable into an asymptotic series. The requirement of uniform validity of the asymptotic solution determines the explicit dependence of certain functions occurring in the asymptotic series on a certain number of clocks, and the explicit dependence of the those clocks on the original independent variable. Any remaining indeterminancy is removed by invoking the concept of restriction of number of clocks. The method is shown to generalize various well-known asymptotic perturbation techniques. Dissert. Abstr.

N73-28833 Illinois Univ., Urbana.
AN INVESTIGATION OF ROTATIONAL VELOCITIES IN CLOSE VISUAL BINARY STARS Ph.D. Thesis
Edward Wayland Weis 1972 61 p
Avail: Univ. Microfilms Order No. 73-10082

Previous investigations of rotational velocities in eclipsing binary stars by other workers have indicated a strong tendency for the rotational axes of these stars to be aligned perpendicularly to their orbital planes. The purpose of this investigation was to determine the extent to which this tendency is exhibited in visual binary stars having separations roughly two orders of magnitude larger than the systems studied previously. To this end, high dispersion spectra of 57 visual binary systems having published orbits were obtained. Rotational velocities were determined by comparing the measured half width of a number of absorption lines in the observed spectra with the half widths of theoretically broadened profiles of the same absorption lines. The rotational velocities are essentially on the Slettebak system. In addition, photoelectric photometry on the UVby and H Beta systems was obtained for most of these binaries. Spectral classifications on a pseudo MK system have been obtained from these observations for the program binaries not having a previous MK classifications. Dissert. Abstr.

N73-28834 Northwestern Univ., Evanston, Ill.
SPECTROSCOPIC OBSERVATIONS OF SOME SOUTHERN RED VARIABLES Ph.D. Thesis
Lee Will Simon 1972 139 p
Avail: Univ. Microfilms Order No. 73-10286

Spectrograms of 111 long-period, semi-regular, and irregular red variables of types M, N, R, and S, as well as standard stars, were taken during 1965-1967 on the Meinel spectrograph of the 40-inch reflector at the Siding Spring Observatory of Australian National University near Coonabarabran, New South Wales, Australia. Many of the spectrograms were of variables which lacked good spectroscopic investigation. The plates generally cover the wavelength region lambda lambda 3600-4900. Radial velocities for these variables were determined. All the spectrograms have been classified, and intensity estimates made of the interesting spectral features on the M, N, R, and S stars. Individual radial velocities of the numerous emission lines are included, and the spectral features of each star discussed. Microdensitometer tracings were made of all the spectrograms and sensitometer spots. Intensities of the spectral features and equivalent widths were calculated for selected spectrograms.
Dissert. Abstr.

N73-28835 Illinois Univ., Urbana.
A THEORY FOR THE BARS OF BARRED SPIRAL GALAXIES Ph.D. Thesis
George Demosthenes Nickas 1972 134 p
Avail: Univ. Microfilms Order No. 73-10013

A two armed bar shaped density wave was investigated. The results of the theory are applied to the very long bar of NGC 7479 -- an SB(s) system. It is found that such a wave can exist as a perturbation to the axisymmetric inner disk. The angular speed of the pattern apparently must exceed that of

the disk matter by about 25%. It is also found that the inner disk probably has an approximately Gaussian axisymmetric surface density leading to an approximately linear rotation curve and force law in the inner disk. A superposition of the perturbation and axisymmetric surface densities indicates a fairly uniform total density distribution along the bar. These findings are in good agreement with the limited observational data on NGC 7479. The mass of NGC 7479 is estimated to be about five times the mass of the bar. Finally it is suggested that the bar of NGC 7479, as a wave, has an angular speed of five times the angular speed of the outer tightly wound arms which are also assumed to be waves. Dissert. Abstr.

N73-28836 Virginia Univ., Charlottesville.
LOW VELOCITY INTERSTELLAR NEUTRAL HYDROGEN IN THE LOCAL REGION OF THE GALAXY Ph.D. Thesis
Joseph Willis Mast 1972 162 p
Avail: Univ. Microfilms Order No. 73-9729

Twenty-one centimeter radiation was observed at 835 positions in the galaxy with NRAO 140- and 300radio telescopes. The observations represent a general survey of the low velocity, interstellar neutral atomic hydrogen gas at intermediate and high galactic latitudes. Four hundred and forty-three of these observations were in the directions of early type stars. The literature contains optical observations of the interstellar calcium or sodium lines in 320 of these stars. The current model of the interstellar gas, sometimes called the two-component model, consists of a picture of cooler clouds embedded in a continuous, hotter medium. Analysis of this survey of neutral hydrogen gas reveals that in the local region of our galaxy the interstellar gas consists of two main components: a diffuse, broad, background component and a component with narrow velocity width which coincides in velocity with components of optical interstellar lines observed in the same directions. Dissert. Abstr.

N73-28837 Maryland Univ., College Park.
LINE-BLANKETED MODEL STELLAR ATMOSPHERES APPLIED TO SIRIUS Ph.D. Thesis
John Wendell Fowler 1972 244 p
Avail: Univ. Microfilms Order No. 73-9698

The primary goal of the analysis was to determine whether the effects of atomic bound-bound transitions on stellar atmospheric structure can be represented well in models. The investigation is based on an approach which is called the method of artificial absorption edges. The method is described, developed, tested, and applied to the problem of fitting a model stellar atmosphere to Sirius. It is shown that the main features of the entire observed spectrum of Sirius can be reproduced to within the observational uncertainty by a blanketed flux-constant model with effective T = 9700 K and Log g = 4.26. The profile of H lambda is reproduced completely within the standard deviations of the measurements except near the line center, where non-LTE effects are expected to be significant. The equivalent width of H lambda, the Paschen slope, the Balmer jump, and the absolute flux at 5550 A all agree with the observed values. The gravity agrees with that determined from the orbital parameters of the Sirius A and B system and the observed angular diameter of Sirius. Dissert. Abstr.

N73-28838 Cornell Univ., Ithaca, N.Y.
ROCKET INFRARED MULTICOLOR OBSERVATIONS OF THE INTERPLANETARY MEDIUM H II REGIONS, AND THE GALACTIC CENTER REGION Ph.D. Thesis
Baruch Thomas Soifer 1972 123 p
Avail: Univ. Microfilms Order No. 73-9366

Astronomical observations at 5 microns, 13 microns, 20 microns, and 10 microns, obtained in two flights of the Cornell liquid helium cooled rocket telescope are reported. The successful launches of the payload occurred at 01:32 MST on 2 December 1970 and at 21:53 MST on 16 July 1971. Infrared emission was discovered to be associated with the ecliptic plane. It is found that this emission can be attributed to thermal emission from particles in the interplanetary medium. The required particle density is found to be in accord with values deduced from optical observations of the zodiacal light. Two H II regions, M8 and NGC 6357, were observed. The infrared emission can be accounted for as thermal radiation by dust particles associated with the nebulae. Dissert. Abstr.

N73-28839 Cornell Univ., New York.
RADIO CONTINUUM AND 21 CM HYDROGEN LINE OBSERVATIONS OF GALACTIC SUPERNOVA REMNANTS Ph.D. Thesis
Linda Kay DeNoyer 1972 206 p
Avail: Univ. Microfilms Order No. 73-10107

Decimetric radio continuum maps of three extended galactic supernova remnants (SNRs), IC 443, S 147, and the Cygnus Loop are presented. The maps of S 147 provide the first complete picture of the radio structure. The radio spectra show that (1) the Cygnus Loop radiates by compression of the interstellar medium, (2) IC 443 requires an internal source of high energy particles, and (3) S 147 has a typical nonthermal SNR spectral index. Hydrogen 21 cm line observations of extended regions around the SNRs are also presented. Hydrogen clouds adjacent to the Cygnus Loop at the position of the optical filaments are identified, as well as turbulent hydrogen within the expanding shells of IC 443 and the Cygnus Loop. Interstellar densities of 10 atoms/cu cm, and hydrogen emission from a dust cloud near the Cygnus Loop are found. Dissert. Abstr.

N73-28840 Purdue Univ., Lafayette, Ind.
PRETERRESTRIAL SHOCK EFFECTS AND SHOCK HARDENING IN AND THE PARENT BODIES OF IRON METEORITES Ph.D. Thesis
Anant Vir Jain 1972 160 p
Avail: Univ. Microfilms Order No. 73-6154

A discussion is presented of the shock history of 214 iron and stony-iron meteorites and its implications as to the parent bodies of these meteorites. Also, presented is a discussion of shock hardening in iron meteorites, 195 of the 214 meteorities studied so far contain indicators which permit their shock history to be specified explicitly. The shock history of iron meteorites, coupled with other physical and chemical properties provides important clues to: (1) the size, number and location of their parent bodies; (2)the genetic relationships between iron meteorites; (3) the nature of the fragmentation processes that produced them. Dissert. Abstr.

N73-28841*# Linguistic Systems, Inc., Cambridge, Mass.
CURRENT ACHIEVEMENTS IN ASTRONAUTICS
A. Vinogradov, Yu. Surkov et al Washington NASA Aug. 1973 69 p Transl. into ENGLISH of the publ. "Sovremenniye Dostizheniya Kosmonavtiki" Moscow, Zhaniye, 1972 48 p
(Contract NASw-2482)
(NASA-TT-F-14929) Avail: NTIS HC $5.50 CSCL 22C

Soviet automatic stations carried out a wide range of investigations of Mars and Venus. Luna-20 brought soil from the continental region of the moon back to earth. The Prognoz satellites are on 24-hour watch along the earth. A number of important agreements were reached between the U.S.S.R. and the U.S.A. in the area in the area of the investigation of space. This collection, basically compiled from materials published in the central printing office, discusses these achievements and the commentaries of well-known Soviet scientists. Author

N73-28842*# Techtran Corp., Silver Spring, Md.
THE CONQUEST OF OUTER SPACE
Torquate Gualiterotti Washington NASA Aug. 1973 12 p Transl. into ENGLISH of an unpublished Italian Article "La Conquista Dello Spazio Esterno" 1973 4 p
(Contract NASw-2485)
(NASA-TT-F-15019) Avail: NTIS HC $3.00 CSCL 22A

The efforts of the manned space program and of the space program are described in relation to physiology. The motion sickness and space sickness difficulties of many of the astronauts are given and how this has stimulated research and innovative methods of researching individual sensors, particularly in the inner ear is shown. Author

N73-28843*# Techtran Corp., Silver Spring, Md.
RHYTHMS ON THE EARTH AND IN SPACE, CHAPTER 9
Ye. V. Maksimov Washington NASA Jul. 1973 21 p refs Transl. into ENGLISH from the book "Problemy Oledeniya Zemli i Ritmy v Prirode" Leningrad, Nauka, 1972 p 250-268
(Contract NASw-2485)
(NASA-TT-F-14985) Avail: NTIS HC $3.25 CSCL 03B

An attempt was made to establish the existence of certain

rhythms of the earth. Research shows that in both the glacio-climatic and geophysical, and possibly, in the biological phenomena of the earth there are clearcut signs of the existence of certain rhythms which interfere with each other. The statistical data pertaining to the last centuries indicate the existence of a 22 to 24 year rhythm which is actually a double 11 year rhythm, as well as a multicentury rhythm which is manifested in an overall increase in the activity of the earth over the course of the last 200 to 300 years. It was indicated that there is some basis to mention the existence of similar rhythms is space phenomena (meteorites, comets, the activity of the other planets of the solar system, solar and stellar activity). Additionally, the mechanism linking the rhythms of space and the earth is at present vague. Author

N73-28844*# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
OUTER PLANETS GRAND TOURS: PLANETARY RADIO ASTRONOMY TEAM REPORT
James W. Warwick 1 Feb. 1972 101 p refs
(Grant NGR-06-003-185)
(NASA-CR-133500) Avail: NTIS HC $7.25 CSCL 22A

Requirements related to scientific observations of planetary radio emissions during outer planets grand tours are discussed. Observations at low frequencies where non-thermal cooperative plasma phenomena play a major role are considered for determining dynamical processes and magnetic fields near a planet. Magnetic field measurements by spacecraft magnetometers, and by radio receivers in their harmonic modes are proposed for interpretation of planetary radio emission. G.G.

N73-28845*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
APPLICATION OF MATCHED ASYMPTOTIC EXPANSIONS TO LUNAR AND INTERPLANETARY TRAJECTORIES. VOLUME 2: DERIVATIONS OF SECOND-ORDER ASYMPTOTIC BOUNDARY VALUE SOLUTIONS
J. E. Lancaster Washington NASA Jul. 1973 191 p refs
(Contract NAS9-10526)
(NASA-CR-2256; MDC-G2748-Vol-2) Avail: NTIS HC $3.00 CSCL 03B

Previously published asymptotic solutions for lunar and interplanetery trajectories have been modified and combined to formulate a general analytical solution to the problem of N-bodies. The earlier first-order solutions, derived by the method of matched asymptotic expansions, have been extended to second order for the purpose of obtaining increased accuracy. The complete derivation of the second-order solution, including the application of a rigorous matching principle, is given. It is shown that the outer and inner expansions can be matched in a region of order mu to the alpha power, where $2/5 < \text{alpha} < 1/2$, and mu (the moon/earth or planet/sun mass ratio) is much less than one. The second-order asymptotic solution has been used as a basis for formulating a number of analytical two-point boundary value solutions. These include earth-to-moon, one- and two-impulse moon-to-Earth, and interplanetary solutions. Each is presented as an explicit analytical solution which does not require iterative steps to satisfy the boundary conditions. The complete derivation of each solution is shown, as well as instructions for numerical evaluation. For Vol. 1, see N73-27738. Author

N73-28846*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE BMW ANALYTIC AERODYNAMIC DRAG METHOD FOR THE VINTI SATELLITE THEORY
J. S. Watson, G. D. Mistretta, and N. L. Bonavito Dec. 1972 53 p refs
(NASA-TM-X-70418; X-591-72-499) Avail: NTIS HC $4.75 CSCL 22A

In order to retain separability in the Vinti theory of earth satellite motion when a non conservative force such as air drag is considered, a set of variational equations for the orbital elements are introduced, and expressed as functions of the transverse, radial, and normal components of the nonconservative forces acting on the system. In particular, the atmospheric density profile is written as a fitted exponential function of the eccentric anomaly, which reproduces tabular values of static model atmospheric densities at all altitudes to within ninety-eight percent and simultaneously reduces the variational equations to indefinite integrals with closed form evaluations, whose limits are in terms of the eccentric anomaly. The values of the limits for any arbitrary time interval are obtained from the Vinti program. Results of the BMW (Bonavito, Mistretta, Watson) theory for the case of the intense air drag satellites San Marco-2 and Air Force Cannonball are given. These results indicate that the satellite ephemerides produced by the BMW theory in conjunction with the Vinti program are of very high accuracy. In addition, since the program is entirely analytic, several months of ephemerides can be obtained within a few seconds of computer time. Author

N73-28847*# TRW Systems Group, Redondo Beach, Calif.
MISSION REQUIREMENTS FOR A MANNED EARTH OBSERVATORY. TASK 2: REFERENCE MISSION DEFINITION AND ANALYSIS, VOLUME 2
31 May 1973 269 p refs 4 Vol.
(Contract NAS8-28013)
(NASA-CR-124340; TRW-21324-6002-RU-00-Vol-2) Avail: NTIS HC $15.50 CSCL 22A

The mission requirements and conceptual design of manned earth observatory payloads for the 1980 time period are discussed. Projections of 1980 sensor technology and user data requirements were used to formulate typical basic criteria pertaining to experiments, sensor complements, and reference missions. The subjects discussed are: (1) mission selection and prioritization, (2) baseline mission analysis, (3) earth observation data handling and contingency plans, and (4) analysis of low cost mission definition and rationale. Author

N73-28848*# TRW Systems Group, Redondo Beach, Calif.
MISSION REQUIREMENTS FOR A MANNED EARTH OBSERVATORY. TASK 3: CONCEPTUAL DESIGN, VOLUME 3
31 May 1973 315 p refs 4 Vol.
(Contract NAS8-28013)
(NASA-CR-124338; TRW-21324-6003-RU-00-Vol-3) Avail: NTIS HC $17.75 CSCL 22A
For abstract, see N73-28847

N73-28849*# TRW Systems Group, Redondo Beach, Calif.
MISSION REQUIREMENTS FOR A MANNED EARTH OBSERVATORY. TASK 4 PROGRAMMATICS, VOLUME 4
31 May 1973 48 p refs 4 Vol.
(Contract NAS8-28013)
(NASA-CR-124339; TRW-21324-6004-RU-00-Vol-4) Avail: NTIS HC $4.50 CSCL 22A
For abstract, see N73-28847

N73-28850*# Alabama Univ., Huntsville. School of Graduate Studies and Research.
ATOM BEAM SURFACE INTERACTION STUDIES: EXPERIMENTAL SYSTEM DEVELOPMENT Final Report
John C. Gregory Jun. 1973 36 p refs
(Contract NAS8-28071)
(NASA-CR-124309) Avail: NTIS HC $4.00 CSCL 22C

Quantitative deposition by standard techniques of adsorbates containing C and Si onto selected substrates is studied. The interaction kinetics of a beam of oxygen, nitrogen, or hydrogen atoms of known flux are investigated by Auger electron spectroscopy and LEED. Desorbed molecules will be analyzed by mass spectroscopy using modulated beam techniques. Experimental conditions permitting, two sets of measurements will be correlated. Author

N73-28851*# Purdue Univ., Lafayette, Ind.
Zr PARTITIONING AND KINETICS AND MECHANISM Final Progress Report
Lawrence A. Taylor 22 Mar. 1973 9 p refs
(Grant NGR-15-005-175)
(NASA-CR-133333) Avail: NTIS HC $3.00 CSCL 03B

The results of investigations concerning the cooling histories of lunar rocks are reported. Publications resulting from this research are listed. Studies discussed include the partitioning of Zr between FeTi03 and Fe2Ti04 in the presence of Fe + Zr02, and ulvospinel reduction. F.O.S.

N73-28852*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
CONVECTION IN SKYLAB M512 EXPERIMENTS M551, M552, AND M553. PHASE B REPORT Phase B Report, period ending 15 Jul. 1973
S. V. Bourgeois, Jr. Jul. 1973 75 p refs
(Contract NAS8-27015)
(NASA-CR-124329; LMSC/HREC-TR-D306697) Avail: NTIS HC $5.75 CSCL 22C

A study was made of convection in Skylab molten metals and their attendant solidification theory. Particular attention was given to clarifying the effects of reduced gravity on molten flow solidification. The experiments studied include M551, M552, M553, and M556. Author

N73-28853*# Harvard Univ., Cambridge, Mass. Hoffman Lab.
MELTING BEHAVIOR AND PHASE RELATIONS IN THE LUNAR INTERIOR Final Report, 1 May 1970 - 30 Apr. 1973
James Fred Hays 30 Jun. 1973 12 p refs
(Grant NGR-22-007-175)
Avail: NTIS HC $3.00 CSCL 03B

Phase equilibrium experiments at both high and low pressures on lunar samples and synthetic compositions are reported as well as related petrographic studies of lunar rock samples. The objectives were to trace the origins of rocks found on the lunar surface, to characterize the nature of the lunar interior and to locate and identify the sources of lunar magmas. Author

N73-28854*# Martin Marietta Corp., Baltimore, Md. Research Institute for Advanced Studies.
A UNIFIED METABOLISM FOR MARS: A NEW APPROACH DEVELOPED FROM RESEARCH ON EXTRATERRESTRIAL LIFE DETECTION BY ENZYMATICALLY INDUCED EXCHANGE OF O 18 Final Report, 5 Feb. 1971 - 30 Jun. 1972
30 Jun. 1972 19 p
(Contract NASw-2182)
(NASA-CR-133186) Avail: NTIS HC $3.00 CSCL 03B

A general graded life detection approach ranging from environmental and in situ observations to specific metabolic experiments on Mars is reported. A zero dead volume leak and computer mediated data acquisition system is also discussed. Soil analyses were also conducted. E.H.W.

N73-28855*# Analytical Mechanics Associates, Inc., Seabrook, Md.
TWO IMPULSE TRAJECTORY OPTIMIZATION FOR THE RAE-B ORBIT TRIM PROBLEM
Mary H. Payne, Samuel Pines, and Jerry L. Horsewood May 1972 22 p refs
(Contract NAS5-11900)
(NASA-CR-130226; Rept-72-23) Avail: NTIS HC $3.25 CSCL 22C

The results are reported of work on an appropriate approach to the solution of the optimum two-impulse transfer problem between orbits of specified inclination. The task included a literature search to identify the current state of the art and a definition of the suggested approach for the specific application of a lunar orbit trim. The applications of the results to the problem are included. The formulation for a computer program developed under this task following a more conventional approach is also included. Author

N73-28856# European Space Operations Center, Darmstadt (West Germany).
PERTURBATIONS OF THE ORBIT OF A SPACE PROBE BY THE RING OF ASTEROIDS
Shin Yabushita Paris ESRO Sep. 1972 25 p refs
(ESRO-SR-19) Avail: NTIS HC $3.25

Perturbations of the orbit of a space probe around the sun are calculated on the assumption that asteroids can be represented by a circular gravitating ring with its center at the sun. Secular perturbations of longitude of perihelion, longitude of ascending node, inclination, and eccentricity are obtained. The ring causes the advance of perihelion and recession of the nodes. Periodic perturbations of semi-major axis and eccentricity are also calculated. The magnitude of the perturbations is proportional to the ratio, M/M sub s of the aggregate mass of asteroids to the sun's mass. If M is 1/500 earth mass or smaller, as is estimated by observations of optically detectable asteroids, the perturbations are too small to be detected. On the other hand, if M is 1/100 earth mass, the periodic perturbation of the semi-major axis is 27 meters, and is large enough to be measured. Author (ESRO)

N73-28857# Mons Univ. (Belgium). Dept. d'Astrophysique.
ECLIPTIC COORDINATES OF SELECTED HOT STARS
Leo Houziaux and Adela Ringuelet 1972 53 p refs
(Commun-27) Avail: NTIS HC $4.75

The 1970.0 ecliptic coordinates alpha, beta of 1789 are listed. The stars have been selected according to their expected brightness around 2000 A. The list includes hot objects since the V magnitude has been set up at 6.5 for O-type, 6 for the B-type, 5.5 for the A-type, and 3 for the G-type. The 1970.0 ecliptic coordinates of all stars in the SAO catalog have been computed and rearranged according to increasing longitudes. ESRO

N73-28858# Mons Univ. (Belgium).
FINDING LIST FOR BAYER AND FLAMSTEED STARS IN THE 'ECLIPTIC COORDINATES OF SELECTED HOT STARS' CATALOGUE
Gerard Houziaux 1972 12 p
(Commun-31) Avail: NTIS HC $3.00

In order to easily locate bright stars with Bayer or Flamsteed designations in the Ecliptic Coordinates of Selected Hot Stars Catalog, the stars were rearranged by constellations, given in alphabetical order. For each object, the 1970.0 ecliptic longitude is given. Among the 1789 stars on the list of ecliptic coordinates, 1126 appear in the Bayer or/and Flamsteed catalog. ESRO

N73-28859# Naval Weapons Lab., Dahlgren, Va. Warfare Analysis Dept.
RELATIVISTIC EFFECTS IN SATELLITE DYNAMICS AND DOPPLER TRACKING
M. D. Harkins May 1973 19 p refs
(AD-762400; NWL-TR-2965) Avail: NTIS CSCL 22/3

The principal relativistic effects of interest for the problems of satellite tracking and orbit prediction are considered. Due to relativistic modifications of Newtonian dynamics, the perifocus of a satellite orbiting in a central field will advance at a fixed rate. This effect is cumulative and for a typical earth satellite amounts to an advance of perigee of about one meter a day. An expression is given for obtaining a classical perturbation term which reproduces this relativistic effect to second order. The classical Doppler shift is also modified since the rate at which clocks run will depend, according to relativity, on their state of motion and the strength of the gravitational field at their location. For Doppler tracked earth satellites, the effective correction varies sinusoidally with the true anomaly. For some typical earth satellites the amplitude ranges from a few parts in 10 to the -12th power up to a few parts in 10 to the -10th power. Author (GRA)

N73-28767* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MATTER-ANTIMATTER COSMOLOGY
R. Omnes *In its* Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 22 p refs (For availability see N73-28753 19-29)
CSCL 03B

N73-28771* Yale Univ., New Haven, Conn.
ANTIMATTER IN THE UNIVERSE?
Gary Steigman *In* NASA. Goddard Space Flight Center Intern. Symp. and Workshop on Gamma-Ray Astrophysics Jun. 1973 11 p refs (For availability see N73-28753 19-29)
CSCL 03B

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also; 28 Propulsion Systems; and 32 Structural Mechanics.

N73-28860*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 1: EXECUTIVE SUMMARY REPORT
Jun. 1973 25 p refs
(Contract NAS9-12909)
(NASA-CR-133968; SD-73-SA-0036-1) Avail: NTIS HC $3.25 CSCL 22B

A study was undertaken to examine the feasibility of employing space platforms for geosynchronous operations. The basic approach taken was to define two geosynchronous traffic models and to develop a logical pattern of subsequent analyses leading to the definition of system requirements and conceptual platform designs for each model. Alternative geosynchronous programs were defined using various configurations and operational modes, which were then evaluated to determine a recommended geosynchronous program approach. Later, attention was focused on transportation interfaces in order to define the desired match between geosynchronous platforms and transportation system elements. D.L.G.

N73-28861*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 2: OVERALL STUDY SUMMARY
Jun. 1973 136 p refs
(Contract NAS9-12909)
(NASA-CR-133969; SD-73-SA-0036-2) Avail: NTIS HC $9.00 CSCL 22B

The significant results obtained in the study are summarized. Principal supporting data are presented along with conclusions and recommendations. D.L.G.

N73-28862*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 3: GEOSYNCHRONOUS MISSION CHARACTERISTICS
Jun. 1973 209 p refs
(Contract NAS9-12909)
(NASA-CR-133970; SD-73-SA-0036-3) Avail: NTIS HC $12.50 CSCL 22B

The objectives of the study were to examine the nature of currently planned and new evolutionary geosynchronous programs, to analyze alternative ways of conducting missions, to establish concepts for new systems to support geosynchronous programs in an effective and economical manner, and to define the logistic support to carry out these programs. In order to meet these objectives, it was necessary to define and examine general geosynchronous mission characteristics and the potentially applicable electromagnetic spectrum characteristics. An organized compilation of these data is given with emphasis on the development and use of the data. Fundamental geosynchronous orbit time histories, mission profile characteristics, and delivery system characteristics are presented. In addition, electromagnetic spectrum utilization is discussed in terms of the usable frequency spectrum, the spectrum potentially available considering established frequency allocations, and the technology status as it affects the ability to operate within specific frequency bands. Author

N73-28863*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 4, PART 1: TRAFFIC ANALYSIS AND SYSTEM REQUIREMENTS FOR THE BASELINE TRAFFIC MODEL
Jun. 1973 157 p refs
(Contract NAS9-12909)
(NASA-CR-133971; SD-73-SA-0036-4-Vol-4-Pt-1) Avail: NTIS HC $10.00 CSCL 22A

The traffic analyses and system requirements data generated in the study resulted in the development of two traffic models; the baseline traffic model and the new traffic model. The baseline traffic model provides traceability between the numbers and types of geosynchronous missions considered in the study and the entire spectrum of missions foreseen in the total national space program. The information presented pertaining to the baseline traffic model includes: (1) definition of the baseline traffic model, including identification of specific geosynchronous missions and their payload delivery schedules through 1990; (2) Satellite location criteria, including the resulting distribution of the satellite population; (3) Geosynchronous orbit saturation analyses, including the effects of satellite physical proximity and potential electromagnetic interference; and (4) Platform system requirements analyses, including satellite and mission equipment descriptions, the options and limitations in grouping satellites, and on-orbit servicing criteria (both remotely controlled and man-attended). Author

N73-28864*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 4, PART 2: TRAFFIC ANALYSIS AND SYSTEM REQUIREMENTS FOR THE NEW TRAFFIC MODEL
Jun. 1973 190 p refs
(Contract NAS9-12909)
(NASA-CR-133972; SD-73-SA-0036-4-Vol-4-Pt-2) Avail: NTIS HC $11.50 CSCL 22A

A condensed summary of the traffic analyses and systems requirements for the new traffic model is presented. The results of each study activity are explained, key analyses are described, and important results are highlighted. Author

N73-28865*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 5: GEOSYNCHRONOUS PLATFORM SYNTHESIS
Jun. 1973 317 p refs
(Contract NAS9-12909)
(NASA-CR-133973; SD-73-SA-0036-5) Avail: NTIS HC $18.00 CSCL 22B

The development is described of the platform configurations, support subsystems, mission equipment, and servicing concepts. A common support module is developed; subsystem concepts are traded off; data relay, TDRS, earth observational, astrophysics, and advanced navigation and traffic control mission equipment concepts are postulated; and ancillary equipment required for delivery and on-orbit servicing interfaces with geosynchronous platforms is grossly defined. The general approach was to develop a platform concept capable of evolving through three on-orbit servicing modes: remote, EVA, and shirtsleeve. The definition of the equipment is to the assembly level. Weight, power, and volumetric data are compiled for all the platforms. Author

N73-28866*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 6: GEOSYNCHRONOUS PROGRAM EVALUATION AND RECOMMENDATIONS
H. L. Myers Jun. 1973 127 p ref
(Contract NAS9-12909)
(NASA-CR-133974; SD-73-SA-0036-6-Vol-6) Avail: NTIS HC $8.50 CSCL 22A

The programmatic analyses conducted to achieve the objectives of the study are presented. The characteristics are examined of alternate geosynchronous programs based on servicing concepts, geosynchronous platform configurations, and equipment definitions which have evolved during the study. The logistics support necessary to carry out programs using these systems is defined considering alternate approaches for on-orbit servicing. The costs of the resultant programs are then determined and the alternate program approaches compared. Conventional programs with expendable satellites are also defined to the extent necessary to permit comparison with on-orbit serviced platform programs. Author

N73-28867*# Rockwell International Corp., Downey, Calif. Space Div.
GEOSYNCHRONOUS PLATFORM DEFINITION STUDY. VOLUME 7: GEOSYNCHRONOUS TRANSPORATION REQUIREMENTS
H. L. Myers Jun. 1973 151 p refs
(Contract NAS9-12909)
(NASA-CR-133975; SD-73-SA-0036-7-Vol-7) Avail: NTIS HC $9.75 CSCL 22A

The analyses and trade studies are presented which were conducted to define the interfaces between geosynchronous platforms and the space transportation system. Mission timelines are synthesized for both manned and unmanned placement and servicing operations. Physical, operational, and functional interfaces between platforms and the space shuttle and tug are derived from the timelines. Where interface incompatibilities exist, alternate approaches are evaluated and a preferred approach is defined. An evaluation of the adaptation of the solar electric propulsion (SEP) stage for geosynchronous operations is presented. A comparison of geosynchronous platform programs with and without the SEP stage in the transportation system is developed. Author

N73-28868*# Martin Marietta Corp., Denver, Colo.
COMPOSITE PROPULSION FEEDLINES FOR CRYOGENIC SPACE VEHICLES, VOLUME 1 Final Report, Jun. 1970 - Dec. 1972
C. A. Hall, D. J. Laintz, and J. M. Phillips Aug. 1973 168 p refs
(Contract NAS3-14370)
(NASA-CR-121137-Vol-1) Avail: NTIS HC $10.50 CSCL 22B

Thin metallic liners that provide leak-free service in cryogenic propulsion systems are overwrapped with a glass-fiber composite that provides strength and protection from handling damage. The resultant tube is lightweight, strong and has a very low thermal flux. Several styles of tubing ranging from 5 to 38 cm in diameter and up to 305 cm long were fabricated and tested at operating temperatures from 294 to 21 K and operating pressures up to 259 N/sq cm. The primary objective for the smaller sizes was thermal performance optimization of the propulsion system while the primary objective of the larger sizes was weight optimization and to prove fabricability. All major program objectives were met resulting in a design concept that is adaptable to a wide range of aerospace vehicle requirements. Major items of development included: bonding large diameter aluminum end fittings to the thin Inconel liner; fabrication of a 38 cm diameter tube from 0.008 cm thick Inconel; and evaluation of tubing which provides essentially zero quality propellant in a very short period of time resulting in a lower mass of propellant expended in chilldown. Author

N73-28869*# Martin Marietta Corp., Denver, Colo.
COMPOSITE PROPULSION FEEDLINES FOR CRYOGENIC SPACE VEHICLES, VOLUME 2: APPENDICES Final Report, Jun. 1970 - Dec. 1972
C. A. Hall, D. J. Laintz, and J. M. Phillips Aug. 1973 176 p
(Contract NAS3-14370)
(NASA-CR-121137-Vol-2) Avail: NTIS HC $11.00 CSCL 22B

For abstract, see N73-28868

N73-28870*# Vought Aeronautics, Dallas, Tex.
A LOW SPEED WIND TUNNEL TEST OF THE 0.050 SCALE NASA-JSC SHUTTLE ORBITER 089B TO DETERMINE THE LONGITUDINAL AND LATERAL DIRECTIONAL EFFECTS OF CONTROL SURFACE MODIFICATIONS Test Report, 24 Apr. - 2 May 1973
R. H. Oldenbuttel 8 Jun. 1973 244 p
(Contract NAS9-12731)
(NASA-CR-133979; LSWT-422; MSC-06799) Avail: NTIS HC $14.25 CSCL 22B

Wind tunnel tests to determine the longitudinal and lateral-directional effects of control surface modifications on the space shuttle orbiter aerodynamic characteristics are discussed. A total of 103 data runs were made which consisted of pitch runs through a range of zero to 28 degrees at a zero yaw angle and yaw runs from minus 6 to plus 6 degrees at various fixed pitch angles. At each data point, data from an internal strain gage balance was sampled with the digital data system. Also recorded were the model angles of pitch and yaw and the test section static pressure. Results are presented in the form of tabulated aerodynamic coefficient data about the model reference center. Author

N73-28871# National Environmental Satellite Service, Washington, D.C.
SATELLITE ACTIVITIES OF NOAA, 1972
Jun. 1973 10 p
Avail: NTIS HC $3.00

The satellite activities of the National Oceanic and Atmospheric Administration are reported. Topics discussed include: development and application of environmental satellite technology, international cooperation, solar physics, upper atmosphere physics, and environmental data programs. F.O.S.

N73-28872# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES MADE DURING THE MONTH OF MARCH 1973
R. D. Eberst 18 Apr. 1973 35 p
(ROE-STS-151) Avail: NTIS HC $3.75

Stopwatch observations made at stations during March 1973 are listed in satellite launch and time order: 662 fully reduced observations of 164 satellites. Author (ESRO)

N73-28873# Royal Observatory, Edinburgh (Scotland). Satellite Tracking Section.
STOPWATCH OBSERVATIONS OF SATELLITES MADE DURING THE MONTH OF APRIL 1973
R. D. Eberst 22 May 1973 26 p
(ROE-STS-152) Avail: NTIS HC $3.50

Stopwatch observations made at stations connected with the satellite tracking section during April 1973 are listed in satellite launch and time order. Some 418 fully reduced observations of 110 satellites are given. Author (ESRO)

N73-28874# Instituto Nacional de Tecnica Aeroespacial, Madrid (Spain).
FOLDABLE ELASTIC TUBES FOR HINGES ON SATELLITES Final Report
J. Fernandez-Sintes and J. C. Cristos Paris ESRO Feb. 1973 177 p refs
(Contract ESTEC-729/69)
(ESRO-CR-65) Avail: NTIS HC $11.00

The results of a program for the design, development, and testing of foldable tubes for hinges on satellites are reported. The conventional type of foldable elastic tube (FET) is first considered. Design criteria and manufacturing techniques are presented in detail as applied to the construction of a development unit. In the evaluation of this unit two main problem areas acquired special significance: the buckled self-equilibrium state and concentration of stresses. Analyses of these problems led to the development of a new concept: the prestressed foldable tube with lobular edges (INTA TEP). The new concept is presented, and details of its design are given. Ten INTA TEP hinges were constructed and subjected to evaluation and tests of flexural stiffness, flexural instability, post-buckling behavior, torsional stiffness and torsional instability. Flexural tests in a thermal chamber at +80 C and -40 C were also conducted. An experimental foldable boom system integrating three INTA TEP hinges was constructed and tested in conditions of free self deployment with gravity compensation. The deployment sequence was recorded and the boom-tip accelerations measured. Author (ESRO)

N73-28875# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
FEASIBILITY OF A DEEP SPACE SOLAR ACTIVITY MONITORING PLATFORM WITH VIDEO CAPABILITY M.S. Thesis
David D. Ratcliff Jun. 1973 102 p refs
(AD-761799; GEP/PH/73-18) Avail: NTIS CSCL 22/2

A basic fact of life facing solar forecasters and researchers is that half of the sun is not visible to them. Because of the rotation of the sun, solar activity center which spawn flares are

invisible during part of their lifetime and solar forecasters have only a few days of lead time in their forecasts. This study investigates the feasibility of placing a satellite platform capable of supporting a high-resolution video imaging system on the far side of the sun in the earth's orbit. Other measurements included in the mission are X-ray flux, UV flux charged particle flux, and radio emissions from the sun. The study indicates that the mission is feasible. A design for the vehicle is suggested; proven systems are used in the proposed vehicle with the exception of the attitude control system. Vehicle pointing requirements are met by a proposed attitude control system design which uses radiation pressure torques, optical damping, and a reaction boom to achieve a one-arc-second pointing accuracy for the vehicle.
Author (GRA)

N73-28876# Analytic Sciences Corp., Reading, Mass.
PERFORMANCE EVALUATION OF HOMING GUIDANCE LAWS FOR TACTICAL MISSILES
Charles F. Price and Ronald S. Warren 1 Jan. 1973 112 p refs
(Contract N00014-69-C-0391)
(AD-761626; TASC-TR-170-4) Avail: NTIS CSCL 16/4

A number of homing guidance laws, designed using principles of modern stochastic control theory, are compared using a recently developed analytical technique (CADET) for propagating the statistics of nonlinear, randomly excited systems. The guidance laws include proportional guidance, optimal linear guidance, and optimal nonlinear guidance. Each law is evaluated in a realistic nonlinear model of the missile guidance system and the homing geometry. This work provides a direct comparative evaluation of several important guidance techniques, and extends the usefulness of CADET for analyzing nonlinear guidance systems.
Author (GRA)

N73-28877# Battelle Columbus Labs., Ohio.
THE COLLECTION, GENERATION, AND ANALYSIS OF MIL-HDBK-5 ALLOWABLE DESIGN DATA Annual Report, 15 Feb. 1972 - 15 Feb. 1973
Paul E. Ruff, Ronald J. Favor, and Walter S. Hyler Mar. 1973 118 p refs
(Contract F33615-71-C-1381)
(AD-761817; AFML-TR-73-79) Avail: NTIS CSCL 22/2

The annual report describes highlights of the activities, accomplishments, and progress of the MIL-HDBK-5 program from February 15, 1972, through February 15, 1973, regarding the major functions: (1) liaison with cooperating organizations, (2) assessment of design allowable data requirements, (3) data collection and processing, (4) data analysis and reporting, (5) participation in special task groups, and (6) administrative. GRA

N73-28878# Little (Arthur D.), Inc., Cambridge, Mass.
ANALYSIS OF ROCKET TRAJECTORY DATA FROM TRACKING RADARS Final Report
William R. Schonbein Mar. 1973 149 p refs
(Contract F19628-70-C-0087)
(AD-762203; ADL-C-71932-FR-2; AFCRL-72-0679; FR-2) Avail: NTIS CSCL 19/4

The report describes the mathematical methods and physical models required for the development of an improved rocket trajectory analysis program. This program performs optimal smoothing of radar generated tracking data when these data are available and performs trajectory prediction in those regions where tracking data are not available. The capability of combining radar generated trajectory data from two or more tracking radars to obtain an optimum multiradar trajectory estimate has also been incorporated.
Author (GRA)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N73-28879 Newark Coll. of Engineering, N.J.
VIBRATION AND BUCKLING OF ELASTIC PLATES WITH SHEAR AND ROTARY INERTIA Ph.D. Thesis
Bomi Homi Batiwalla 1972 162 p
Avail: Univ. Microfilms Order No. 73-9593

The effects of shear, rotatory inertia and inplane forces on the transverse vibration of thin plates are studied. In addition, the effect of shear on the buckling of thin plates is examined. A general differential equation of motion is derived for an isotropic thin plate subjected to normal and inplane forces with the consideration of shear and rotatory inertia. The method of internal constraints and Hamilton's principle are utilized. The resulting fourth order differential equation is solved for simply supported plates of various shapes by employing a finite difference technique. The shapes examined are a square, a circle, a circular annulus, and an elliptic annulus. The differential equation is written in its finite difference form and finally as a matrix. The value of the matrix is determined using the lower and upper decomposition method. The first few natural frequencies and the critical buckling loads are obtained using an iterative technique. Dissert. Abstr.

N73-28880*# Scientific Translation Service, Santa Barbara, Calif.
CALCULATION OF NATURAL VIBRATIONS OF SINGLE CYLINDRICALLY CURVED OPEN SHELLS
G. Kotowski Washington NASA Jul. 1973 104 p refs Transl. into ENGLISH of "Berechnung der Eigenschnwingungen einfach kreisbogenfoermig gekruemmter offener Schalen" DFVLR, Goettingen, West Germany, report DLR-FB-71-92
(Contract NASw-2483)
(NASA-TT-F-14979; DLR-FB-71-92) Avail: NTIS HC $7.25 CSCL 20K

The vibration behavior of cylindrically curved panels are treated analytically by application of the Ritz-method taking into account the characteristic bending vibration functions of the uniform beam to represent the plate deflections. The analytical relations are given in a general valuable form for arbitrary boundary conditions. For the panel clamped at one curved edge and free at the others, and the panel clamped at all four edges numerical results are presented and discussed in detail.
Author

N73-28881*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN 4 COMPUTER PROGRAM FOR CALCULATING CRITICAL SPEEDS OF ROTATING SHAFTS
Roger J. Trivisonno Washington Aug. 1973 55 p refs
(NASA-TN-D-7385; E-7017) Avail: NTIS HC $3.00 CSCL 13I

A FORTRAN 4 computer program, written for the IBM DCS 7094/7044 computer, that calculates the critical speeds of rotating shafts is described. The shaft may include bearings, couplings, extra masses (nonshaft mass), and disks for the gyroscopic effect. Shear deflection is also taken into account, and provision is made in the program for sections of the shaft that are tapered. The boundary conditions at the ends of the shaft can be fixed (deflection and slope equal to zero) or free (shear and moment equal to zero). The fixed end condition enables the program to calculate the natural frequencies of cantilever beams. Instead of using the lumped-parameter method, the program uses continuous integration of the differential equations of beam flexure across different shaft sections. The advantages of this method over the usual lumped-parameter method are less data preparation and better approximation of the distribution of the mass of the shaft. A main feature of the program is the nature of the output. The Calcomp plotter is used to produce a drawing of the shaft with superimposed deflection curves at the critical speeds, together with all pertinent information related to the shaft.
Author

N73-28882# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
DOUBLY CURVED TRIANGULAR FINITE ELEMENTS FOR SHELLS OF ARBITRARY SHAPE
H. Garnet and J. Crouzet-Pascal Apr. 1973 106 p refs
(RE-453) Avail: NTIS HC $7.50

A doubly curved triangular finite element, suitable for the small deformation analysis of thin shells containing cutouts and

irregular boundaries, is described. The element chosen represents the middle surface of the undeformed shell exactly; it contains, in addition to its three vertex nodes, three mid-side nodes that may, if desired, be condensed out of the analysis. The six node version comprises 30 degrees of freedom while its condensed version comprises only 27 degrees of freedom; the remaining side is free to represent cutouts or irregular boundaries. A numerical evaluation of both versions of the element was undertaken, by comparing predictions of the present analysis with corresponding predictions of published analytical and numerical analyses. These comparisons involve a broad spectrum of basic cases of spherical and cylindrical shells subject to various loading and boundary conditions. Author

N73-28883*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.

EXPERIMENTS TO STUDY STRAIN GAGE LOAD CALIBRATIONS ON A WING STRUCTURE AT ELEVATED TEMPERATURES

Richard C. Monaghan and Roger A. Fields Washington Aug. 1973 26 p refs

(NASA-TN-D-7390; H-763) Avail: NTIS HC $3.00 CSCL 20K

Laboratory experiments were performed to study changes in strain-gage bridge load calibrations on a wing structure heated to temperatures of 200 F, 400 F, and 600 F. Data were also obtained to define the experimental repeatability of strain-gage bridge outputs. Experiments were conducted to establish the validity of the superposition of bridge outputs due to thermal and mechanical loads during a heating simulation of Mach 3 flight. The strain-gage bridge outputs due to load cycle at each of the above temperature levels were very repeatable. A number of bridge calibrations were found to change significantly as a function of temperature. The sum of strain-gage bridge outputs due to individually applied thermal and mechanical loads compared well with that due to combined or superimposed loads. The validity of superposition was, therefore, established. Author

N73-28884# Advisory Group for Aerospace Research and Development, Paris (France).

TECHNICAL EVALUATION REPORT ON THE AGARD SYMPOSIUM ON RANDOM LOAD FATIGUE

Walter Schuetz (Industrieanlagen-Betriebsgesellschaft m.b.H.) Jun. 1973 13 p refs

(AGARD-AR-54) Avail: NTIS HC $3.00

Brief summaries of the papers presented to the AGARD Symposium are presented. Conclusions and recommendations are included. Topics discussed include: full scale fatigue testing, crack propagation under flight-by-flight loading, fatigue life prediction, measurement and estimation of fatigue loads, damage accumulation, and service experience. F.O.S.

N73-28885*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

THE PROBLEM OF EDGE CRACKS IN AN INFINITE STRIP

G. D. Gupta and F. Erdogan Apr. 1973 19 p refs

(Grants NGR-39-007-011; NSF GK-11977)

(NASA-CR-132288; NASA-TR-73-7; IFSM-73-38) Avail: NTIS HC $3.00 CSCL 20K

The elastostatic plane problem of an infinite strip containing two symmetrically located internal cracks perpendicular to the boundary is formulated in terms of a singular integral equation with the derivative of the crack surface displacement as the density function. The solution of the problem is obtained for various crack geometries and for uniaxial tension applied to the strip away from the crack region. The limiting case of the edge cracks is then considered in some detail. The fundamental function of the integral equation is obtained and a numerical technique for solving the singular integral equations with this particular type of fundamental function which is characteristic of the edge cracks is described. The stress intensity factor for the complete range of net ligament-to-width ratio is calculated. The results also include the solution of the edge crack problem in an elastic half plane. Author

N73-28886*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

INTERACTION BETWEEN A CIRCULAR INCLUSION AND AN ARBITRARILY ORIENTED CRACK

F. Erdogan, G. D. Gupta, and M. Ratwani May 1973 33 p refs

(Grants NGR-39-007-011; NSF GK-11977)

(NASA-CR-132291; IFSM-73-41; NASA-TR-73-10) Avail: NTIS HC $3.75 CSCL 20K

The plane interaction problem for a circular elastic inclusion imbedded into an elastic matrix which contains an arbitrarily oriented crack is considered. Using the existing solutions for the eoge dislocations as Green's functions, first the general problem of a through crack in the form of an arbitrary smooth arc located in the matrix in the vicinity of the inclusion is formulated. The integral equations for the line crack are then obtained as a system of singular integral equation with simple Cauchy kernels. The singular behavior of the stresses around the crack tips is examined and the expressions for the stress intensity factors representing the strength of the stress singularities are obtained in terms of the asymptotic values of the density functions of the integral equations. The problem is solved for various typical crack orientations and the corresponding stress intensity factors are given. Author

N73-28887*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

ON THE EFFECT OF ORTHOTROPY IN A CRACKED CYLINDRICAL SHELL

F. Erdogan, M. Ratwani, and U. Yueceoglu Feb. 1973 14 p refs

(Grant NGR-39-007-011)

(NASA-CR-132295; NASA-TR-73-2; IFSM-73-30) Avail: NTIS HC $3.00 CSCL 20K

A pressurized cylindrical shell containing a longitudinal crack is considered. The shear modulus of the sheet may be evaluated from the measured Young's moduli and the Poisson's ratios rather than being an independent material constant. Two examples, one for a mildly orthotropic (titanium) and the other for a strongly orthotropic (graphite) material approximately satisfying the condition of special orthotropy are given. The results show that the stress intensity factors are rather strongly dependent on the degree of orthotropy. Author

N73-28888*# Lehigh Univ., Bethlehem, Pa. Inst. of Fracture and Solid Mechanics.

BONDED HALF PLANES CONTAINING AN ARBITRARILY ORIENTED CRACK

F. Erdogan and O. Aksogan May 1973 35 p refs

(Grants NGR-39-007-011; NSF GK-11977)

(NASA-CR-132290; IFSM-73-40; NASA-TR-73-9) Avail: NTIS HC $3.75 CSCL 20K

The plane elastostatic problem for two bonded half planes containing an arbitrarily oriented crack in the neighborhood of the interface is consiedred. Using Mellin transforms, the problem is formulated as a system of singular integral equations. The equations are solved for various crack orientations, material combinations, and external loads. The numerical results given include the stress intensity factors, the strain energy release rates, and the probable cleavage angles giving the direction of crack propagation. Author

N73-28889*# Boeing Aerospace Co., Seattle, Wash. Research and Engineering Div.

DEVELOPMENT OF A FRACTURE CONTROL METHOD FOR COMPOSITE TANKS WITH LOAD SHARING LINERS Interim Report, Jul. 1971 - Nov. 1972

W. D. Bixler Mar. 1973 303 p refs

(Contract NAS3-14380)

(NASA-CR-120918; D180-15296-1) Avail: NTIS HC $17.25 CSCL 20K

This experimental program was undertaken to establish a fracture control method for composite tanks with load sharing liners. Uniaxial specimens containing surface flaws were loaded to failure (static fractured) and cycled to failure and the results were compared with burst tests and cyclic life tests of composite tanks having surface flaws present in the load sharing metal liners. The liner materials investigated were Inconel X750 STA, 2219-T62 aluminum and cryostretched 301 stainless steel at room temperature and at 78 K (-320 F) in liquid nitrogen.

Differences were observed in comparing the uniaxial and tank test results. These differences should be resolved if an adequate fracture control method is to be developed. Author

N73-28890*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PERFORMANCE OF STATISTICAL ENERGY ANALYSIS Final Report
R. F. Davis and D. E. Hines Jun. 1973 138 p refs
(Contract NAS8-28435)
(NASA-CR-124322; MDC-G4741) Avail: NTIS HC $9.00 CSCL 20K

Statistical energy analysis (SEA) methods have been developed for high frequency modal analyses on random vibration environments. These SEA methods are evaluated by comparing analytical predictions to test results. Simple test methods are developed for establishing SEA parameter values. Techniques are presented, based on the comparison of the predictions with test values, for estimating SEA accuracy as a function of frequency for a general structure. Author

N73-28891# Aerojet Nuclear Co., Idaho Falls, Idaho.
FATIGUE AND CREEP-FATIGUE BEHAVIOR OF IRRADIATED STAINLESS STEELS: AVAILABLE DATA, SIMPLE CORRELATIONS, AND RECOMMENDATIONS FOR ADDITIONAL WORK IN SUPPORT OF LMFBR DESIGN
C. R. Brinkman, J. M. Beeston, and G. E. Korth Feb. 1973 29 p refs
(Contract AT(10-1)-1375)
(ANCR-1096) Avail: NTIS HC $3.00

The limited data are reviewed and it is tentatively concluded that the reductions or increases in fatigue lifetimes resulting from irradiation can be qualitatively explained in terms of strength and ductility changes reflected in tensile properties. Since irradiated fatigue data covering all possible combinations of temperature, fluence, and strain rate of concern in design will probably never be available, methods of estimating irradiation effects on expected fatigue lifetime will probably have to be developed. One such method is discussed and compared with experimental results. The influence of elevated temperature tensile hold times on the fatigue behavior of irradiated stainless steels is discussed, however, no method of estimating the effect of hold times for design purposes is recommended. Author (NSA)

N73-28892# Materials Research Lab., Inc., Glenwood, Ill.
CRACK ARREST IN AN INCREASING K FIELD
P. B. Crosley and E. J. Ripling Jan. 1973 22 p refs Prepared in cooperation with ORNL
(Contracts W-7405-eng-26; UCCND-3152)
(HSSTP-TR-27) Avail: NTIS HC $3.25

Six tests of single edge notch (SEN) A533 B steel specimens were carried out at room temperature. One specimen did not crack on hydrogen charging. For the other specimens, cracking occurred within the first few minutes' charging time. In three of these specimens the crack was arrested by the base plate, while in the other two, the crack propagated completely through the specimen. It was found that crack-arrest toughness, (Kia,) as measured in an increasing K field, is essentially indentical with Kia measured with a contoured double cantilever beam (DCB) specimen having a zero-K gradient. NSA

N73-28893# Newark Coll. of Engineering, N.J. Dept. of Mechanical Engineering.
OPTIMAL DESIGN OF SUBMERSIBLE FRAME STIFFENED, CIRCULAR CYLINDRICAL HULLS
Michael Pappas and Arnold Allentuch Jul. 1972 90 p refs
(Contract N00014-71-A-0124-0002)
(AD-761643; NCE-NV-6) Avail: NTIS CSCL 13/10

The report presents the results of a series of optimal hull design studies performed using an automated optimum design capability program and procedures. The procedures generate the optimal design of a submersible, T frame stiffened, circular, cylindrical hull segment. GRA

N73-28894# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
EXPERIMENTAL STUDY OF PRESSURE VESSEL MODELS HAVING FABRICATION FLAWS
R. L. Sendelbeck, O. Ljungstrom, B. Ljungstrom, and N. J. Hoff Apr. 1973 35 p refs
(Contract F44620-69-C-0009; AF Proj. 9782)
(AD-761532; SUDAAR-454; AFOSR-73-0856TR) Avail: NTIS CSCL 20/11

Twenty thin-walled circular cylindrical shell specimens were provided with end plates and were ruptured through the application of an internal hydrostatic pressure. The specimens were manufactured by electrodepositing nickel and incorporated simulated weld flaws. It was found that short flaws corresponding to a misalignment along weld seams running in the circumferential direction reduced the bursting pressure much less than similar flaws along weld seams running in the axial direction. As a matter of fact, in the former case the reduction in the bursting pressure was only of the order of magnitude of 5 percent when the flaw had a depth (or offset) of 3.5-times the wall thickness. Author (GRA)

N73-28895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATISTICAL LAWS GOVERNING THE GROWTH OF CRACKS UNDER VARIABLE LOADING
V. P. Pavelko 24 May 1973 16 p refs Transl. into ENGLISH from Vopr. Ekspluatatsionnoi Prochnosti i Nadezhnosti Aviats. Konstrukt. (Riga), v. 6, no. 191, 1971 p 77-86
(AD-761445; FTD-HT-23-258-73) Avail: NTIS CSCL 20/11

The article examines the statistical aspect of crack growth under variable loads. It is shown that the scattering due to the heterogeneity of material decreases as cracks grow. At the same time the loading fluctuations have a considerable effect on the growth rate. (Modified Author Abstract) GRA

N73-28896# Illinois Univ., Urbana. Coordinated Science Lab.
MINIMUM-MASS RESPONSE-CONSTRAINED DESIGN OF VIBRATING SANDWICH BEAMS M.S. Thesis
Philip Catlow Rockenbach May 1973 79 p refs
(Contracts N00014-67-A-0305-0015; DAAB07-72-C-0259)
(AD-761881; R-604; UILU-ENG-73-2206) Avail: NTIS CSCL 13/13

Minimum-mass designs of a damped, linear, continuous sandwich beam are obtained using two different constrained optimal design approaches. The minimum-mass problem is first formulated with a constraint upon the maximum beam response amplitude, and then the problem of miminum-mass with a constraint upon the beam first resonant frequency is treated. In both cases, the constraint is handled using the method of exterior penalty functions, and the optimal designs are obtained using a gradient steepest descent algorithm. The results and usefullness of each design approach are then shown and discussed. Author (GRA)

N73-28897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF CALCULATING BOLTED JOINTS UNDER STRESS RELAXATION AND CREEP CONDITIONS DURING VIBRATIONS
D. Ya. Bragin, I. N. Shkanov, and G. V. Vasilev 7 May 1973 15 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 136, 1971 p 34-41
(AD-761455; FTD-HT-23-276-73) Avail: NTIS CSCL 13/5

The report discusses equations for creep and stress relaxation in nickel-based heat resistant alloys. GRA

N73-28898# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBABILITY CHARACTERISTICS OF THE BEHAVIOR OF A SHALLOW SHELL IN AN ACOUSTICAL FIELD
A. S. Volmir and I. G. Kildbekov 16 May 1973 13 p refs Transl. into ENGLISH from the mono. "Problemy Nadezhnosti v Stroitelnoi Mekhanike" Moscow, Jun. 1968 p 169-174
(AD-761449; FTD-HT-23-236-73) Avail: NTIS CSCL 20/11

The article deals with the problem of the non-linear vibrations and failure of a shallow shell of random shape under the stress of uniformly distributed internal pressure constant with respect to time and subject to the activity of an acoustical stress. The acoustical pressure appears as white noise. Author (GRA)

N73-28899# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CORRELATION OF DISPLACEMENTS IN THIN ELASTIC SHELLS HAVING RANDOM INITIAL IRREGULARITIES
V. V. Bolotin and B. P. Makerov 16 May 1973 12 p refs Transl. into ENGLISH from the monograph "Problemy Nadezhnosti v Stroitelnoi Mekhanike" USSR, Jun. 1968 p 163-168
(AD-761448; FTD-HT-23-234-73) Avail: NTIS CSCL 20/11

Initial imperfections have a substantial effect on the behavior of thin elastic shells subject to a load. The large spread of experimental critical forces is due to these imperfections. The report treats initial deflections as a random field. Assumptions are introduced on the smallness of the deflection scale and the scale of their correlation compared with the characteristic middle surface measurements; there is also one for the homogeneity of the initial irregularity field. Equations obtained by linearizing shell theory equations in the initial stage region are used. (Modified Author Abstract) GRA

N73-28900# Watervliet Arsenal, N.Y.
ON THE STABILITY OF A DEEP BEAM SUBJECTED TO NONCONSERVATIVE AND DISSIPATIVE FORCES
Gary L. Anderson Mar. 1973 50 p refs
(DA Proj. 1F0-61102-A-35D)
(AD-762124; R-WV-T-2-14-73) Avail: NTIS CSCL 13/13

The mode of loss of stability of a hinged-hinged beam subjected to a concentrated, transverse follower force applied at the center of the beam is considered. Due to the nature of the nonconservative applied load, the flexural and torsional deformations of the beam are coupled. The effects of warping rigidity and internal and external damping have been included in the differential equations of motion. The stability problem is solved in an approximate manner by means of an adjoint variational principle. Several graphs are presented to demonstrate the effect of the various damping and rigidity parameters on the value of the flutter load. These results reveal that in the absence of external damping, the value of the flutter load becomes arbitrarily small as the internal damping parameter associated with flexure tends to zero. Author (GRA)

N73-28901# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF A CYLINDRICAL SHELL HAVING RANDOM INITIAL STRESSES
L. A. Movsisyan 16 May 1973 13 p refs Transl. into ENGLISH from the book "Probl. Nadezhnosti v Stroit. Mekhan.", Jun. 1968 p 187-191
(AD-761541; FTD-HT-23-233-73) Avail: NTIS CSCL 20/11

The author discusses the stability of a freely supported circular cylindrical shell under any external pressure which produces an axisymmetric instantaneous stressed state. GRA

N73-28902# Naval Ship Research and Development Center, Bethesda, Md.
DYNAMIC ANALYSIS OF FRAME AND PLATE STRUCTURES WITH GEOMETRIC AND MATERIAL NONLINEARITIES
Theodore G. Toridis May 1973 137 p refs
(AD-762008; NSRDC-3988) Avail: NTIS CSCL 13/10

The objective of this study was the development of a procedure for determining the large dynamic response of structural systems consisting of beam and rectangular plate elements. The analysis takes into account both geometrical and material nonlinearities. The general approach to the problem is based on the finite element method and the use of displacement interpolation functions. The strain energy expressions for both the beam and plate elements are obtained and are used to generate the stiffness and mass matrices of the elements. Also, the geometric stiffness matrices are derived which account for the effect of geometric nonlinearities. Plastic deformations are taken into account by means of an incremental theory of plasticity coupled with the concept of initial strain. (Modified Author Abstract) GRA

N73-28903# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
BIFURCATION CONDITIONS FOR A THICK ELASTIC PLATE UNDER THRUST
K. N. Sawyers and R. S. Rivlin May 1973 46 p refs
(Contract N00014-67-A-0370-0001)
(AD-761941; CAM-100-20) Avail: NTIS CSCL 20/11

A thick rectangular plate of incompressible isotropic elastic material is subjected to a pure homogeneous deformation by tensile forces or thrusts applied to a pair of opposite faces. The theory of small deformations superposed on finite deformations is applied to determine the critical conditions under which bifurcation solutions (i.e. adjacent equilibrium positions) can exist. The adjacent equilibrium positions considered are those for which the superposed deformation is two-dimensional and is coplanar with the loading force and the thickness direction of the plate, the faces of the plate normal to its thickness being force-free. (Modified Author Abstract) GRA

N73-28904# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT IN THE METHOD OF TESTS WITH DIVISION OF THE PROCESS OF FATIGUE FAILURE INTO STAGES OF MACRODAMAGE AND FINAL FAILURE
N. Z. Loginov and I. N. Shkanov 24 May 1973 16 p refs Transl. into ENGLISH from Tr. Aviats. Inst. (Kazan), no. 136, 1971 p 23-33
(AD-761588; FTD-HT-23-266-73) Avail: NTIS CSCL 20/11

A unit was created for fatigue tests with observation for the moment of appearance of the first macrocrack with the use of the stroboscopic effect of illumination of a rotating sample with an ISSh-15 flash lamp. Fatigue curves of macrodamageability and final failure were obtained for notched samples of titanium alloy VT-8. The coefficient of stability of notched samples comprises a value of 0.6 for a mean probability of failure with a level of variable nominal stresses of 28 kgf/sq mm. GRA

N73-28905# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
EXTENSIONS TO THE STAGS COMPUTER CODE Final Report, Oct. 1970 - Oct. 1972
B. O. Almroth, F. A. Brogan, E. Meller, H. T. Petersen, and P. Stern Mar. 1973 76 p refs
(Contract F33615-69-C-1523; AF Proj. 1467)
(AD-761806; AFFDL-TR-73-14) Avail: NTIS CSCL 20/11

Some modifications are reported of a computer code STAGS for structural analysis of general shells. To make the code easier to use, many improvements have been introduced in the input and output procedures. A capability to include finite elements has been introduced in the program; however, only bar elements and membrane plate elements have been included thus far. The code is considered to be a pilot program which can be used in a study of the advantages with the use of such a hybrid code. It should also serve the purpose of defining difficulties that can be encountered in future development of such codes. Author (GRA)

N73-28906# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF AERODYNAMIC RESISTANCE ON THE DAMPING OF VIBRATIONS IN PLANE SPECIMENS
G. V. Shakmanskii 21 May 1973 10 p refs Transl. into ENGLISH from Vopr. Ekspluatatsionnoi Prochnosti i Nadazhnosti Aviats. Konstrukt. (Riga), v. 6, no. 191, 1971 p 103-107
(AD-761591; FTD-HT-23-261-73) Avail: NTIS CSCL 20/11

The report considers the effect of air resistance on the damping of metal plates which are secured cantilever-wise. It is shown that the decrement of free vibrations, corresponding to aerodynamic resistance, with preassigned specimen length and width is practically independent of the amplitude of the stresses, and the damping aerodynamic force is proportional to the rate at which the bending of the specimen changes. (Modified Author Abstract) GRA

N73-28907# Naval Weapons Center, China Lake, Calif.
ESTIMATION OF PEAK STATIC PRESSURE IN A CLOSED CONTAINER
Robert G. S. Sewell and James E. Sinclair Jun. 1973 33 p refs
(AD-762402; NWC-TP-5445) Avail: NTIS CSCL 19/4

A versatile computer program for the Wang 700 series calculator has been developed to process experimental data on

static pressure rise from internal explosions and to estimate the peak static pressure in closed chambers. Author (GRA)

N73-28908# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF MULTILAYER ANISOTROPIC SHELLS
A. G. Teregulov 11 Jun. 1973 14 p refs Transl. into ENGLISH from Issled. Teorii Plastin in Obolochek (USSR), no. 6, 1970 p 762-767
(AD-762224; FTD-HT-23-455-73) Avail: NTIS CSCL 20/11

The report a system of basic equations was derived for thin shells consisting of a large number of homogeneous anisotropic layers, taking into account deformations of lateral shift. The following assumptions are made: normal stresses on areas parallel to the reference surface are negligible as compared with tangential stresses; normal deflection is constant throughout the thickness of the shell; and the law of stress distribution for lateral shift throughout the thickness of the shell is given. GRA

N73-28909# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF A CYLINDRICAL SHELL UNDER THE EFFECT OF A NONUNIFORM RADIAL LOAD
V. I. Shirinskii 8 Jun. 1973 16 p refs Transl. into ENGLISH from Stroit. Mekhan. Raschet Sooruzhenii (USSR), no. 1, 1971 p 44-48
(AD-762242; FTD-HT-23-592-73) Avail: NTIS CSCL 20/11

Formulas are given to find the critical parameter of nonuniform loading and ensure an accuracy sufficient for engineering calculations. If the accuracy yielded by the formulas is insufficient and one is forced to use a computer, then the data obtained from the formulas can ease the computer calculations. GRA

N73-28910# Materials Research Lab., Inc., Glenwood, Ill.
FRACTURING CHARACTERISTICS OF ADHESIVE JOINTS Final Report, 1 Feb. - 31 Dec. 1972
Sheldon Mostovoy and E. J. Ripling 31 Dec. 1972 79 p
(Contract N00019-72-C-0250)
(AD-762457) Avail: NTIS CSCL 13/5

The report, written in three sections, is one in a continuing series on the fracturing characteristics of adhesive joints. The first of these sections, dealing with temperature-toughness profiles of commercial adhesives, is an extension of earlier work and demonstrates the (toughness-transition-temperature) behavior for several (high-toughness) adhesives of interest in the bonding of airframe components. The second of these sections, involving a study of the effect of manufacturing variables (e.g. adhesive type primer, etc.) on stress corrosion cracking (SCC) susceptibility as a function of temperature, compares several commercial adhesives and one simple (low-toughness) adhesive. The third section deals with room-temperature fatigue (or corrosion fatigue) and presents data for room temperature SCC resistant commercial high-toughness adhesives and simple systems. (Modified Author Abstract) GRA

N73-28911# Air Force Systems Command, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF FATIGUE CRACKS IN SPECIMENS WITH CONCENTRATORS UNDER THE ACTION OF VARIOUS TYPES OF LOAD CYCLES
R. M. Vakhitov 24 May 1973 12 p refs Transl. into ENGLISH from Vopr. Ekspluatatsionnoi Prochnosti i Nadezhnosti Aviats. Konstructsiy (Riga), v. 6, no. 191, 1971 p 50-57
(AD-761584; FTD-HT-23-256-73) Avail: NTIS CSCL 20/11

This article presents the results of experiments conducted to show the features of development of fatigue cracks in flat specimens of DI6T material with a central opening acting as concentrator. The specimens were tested on a special installation by different types of pulsating cycles with load factor R = 0.6. The coefficient of cycle asymmetry was r = 0.1. The nature of the influence of the type of load cycle on the rate of crack development in a specimen was established. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N73-28912 Oklahoma Univ., Oklahoma City.
THE ASYMPTOTIC DETERMINATION OF THE EFFECTS OF ABLATION-PRODUCT ABSORPTION-COEFFICIENT ENHANCEMENT ON THE MASS LOSS RATE FROM THE STAGNATION POINT OF A BLUNT BODY IN THE MASSIVE BLOWING REGIME Ph.D. Thesis
Jay Roy Roland 1972 205 p
Avail: Univ. Microfilms Order No. 73-9171

For a blunt body undergoing massive ablation, the stagnation region is treated as two inviscid regions separated by a slip-layer. The momentum equation for each region is solved in quadrature form and then for purposes of calculating the stream function the density of each layer is assumed constant. This leads to an analytical solution of the momentum equation and yields the entire stagnation point geometry. The energy equation is then developed including nongrey absorption and emission of radiation in both the shock and ablation layers. An energy balance at the body surface given the ablation mass loss rate through an effective heat of ablation and thus provides the coupling between the momentum and energy equations. The effects of increasing the ablation layer absorption coefficient are then examined for both a grey and a two energy group absorption coefficient model. Dissert. Abstr.

N73-28913 Akron Univ., Ohio.
PYROLYSIS PRODUCTS OF FLAME RETARDANT TREATED CELLULOSE Ph.D. Thesis
Clinton Lindfield Denson 1972 143 p
Avail: Univ. Microfilms Order No. 73-10368

A large number of compounds obtained from the thermal decomposition of flame retardant treated cellulose have been determined by pyrolysis-gas chromatography-mass spectrometry under conditions which simulate real fires by partial confinement of the gaseous products. The flame retardants used were primarily those containing phosphorus, nitrogen and halogens. Evidence is given to support the proposal that ammonia is one of the more active agents obtained from the decomposition of nitrogen-containing flame retardants. The reaction of ammonia with acids to form nitriles and with methanol to form trimethylamine is proposed. The amount of phosphorus in the retardant affects the production of these compounds. These observations agree with a synergistic action of phosphorus and nitrogen in flame retardants. Dissert. Abstr.

N73-28914# Weapons Research Establishment, Salisbury (Australia).
A COMPUTER PROGRAM TO SOLVE THE ONE DIMENSIONAL HEAT CONDUCTION PROBLEM USING THE HOPSCOTCH ALGORITHM
R. L. Pope and N. F. Mack Mar. 1973 23 p refs
(WRE-TN-884(WR/D)) Avail: NTIS HC $3.25 CSCL 20M

A computer program which will provide solutions to the one dimensional heat flow problem is presented. The program uses the hopscotch algorithm. Some tests of the algorithm are described and estimates given of error variation with step size for problems involving aerodynamic heating. Author

N73-28915*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NET RADIATION METHOD FOR ENCLOSURE SYSTEMS INVOLVING PARTIALLY TRANSPARENT WALLS
Robert Siegel Washington Aug. 1973 33 p refs
(NASA-TN-D-7384; E-7363) Avail: NTIS HC $3.00 CSCL 20M

The net radiation method is developed for analyzing radiation heat transfer in enclosure systems involving partially transparent walls. One such system is an enclosure with windows in it. The conventional net radiation method was developed for enclosures having opaque walls. If a partially transparent wall is present, it

will permit radiation to enter and leave the enclosure. The net radiation equations are developed here for gray and semigray enclosures with one or more windows. Another system of interest, such as in a flat plate solar collector, consists of a series of parallel transparent layers. The transmission characteristics of such window systems are obtained by the net radiation method, and the technique appears to be more convenient than the ray tracing method which has been used in the past. Relations are developed for windows consisting of any number of parallel layers having differing absorption coefficients and differing surface reflectivities, and for systems composed of parallel transmitting layers and opaque plates. Author

N73-28916*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN ITERATIVE SOLUTION OF AN INTEGRAL EQUATION FOR RADIATIVE TRANSFER BY USING VARIATIONAL TECHNIQUE

Kenneth K. Yoshikawa Washington Aug. 1973 29 p refs
(NASA-TN-D-7292; A-4774) Avail: NTIS HC $3.00 CSCL 20M

An effective iterative technique is introduced to solve a nonlinear integral equation frequently associated with radiative transfer problems. The problem is formulated in such a way that each step of an iterative sequence requires the solution of a linear integral equation. The advantage of a previously introduced variational technique which utilizes a stepwise constant trial function is exploited to cope with the nonlinear problem. The method is simple and straightforward. Rapid convergence is obtained by employing a linear interpolation of the iterative solutions. Using absorption coefficients of the Milne-Eddington type, which are applicable to some planetary atmospheric radiation problems. Solutions are found in terms of temperature and radiative flux. These solutions are presented numerically and show excellent agreement with other numerical solutions.
Author

N73-28917*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

VARIABLE CONDUCTANCE HEAT PIPES FROM THE LABORATORY TO SPACE

J. P. Kirkpatrick Jul. 1973 16 p refs
(NASA-TM-X-62290) Avail: NTIS HC $3.00 CSCL 20M

Heat pipes were developed which can be used as (1) a variable conductance link between a heat source and sink which provides temperature stability; (2) a feedback control mechanism that acts to directly maintain the source at a constant temperature; (3) or as a thermal diode that allows heat to be transferred in one direction only. To establish flight level confidence in these basic control techniques, the Ames Heat Pipe Experiment (AHPE) was launched in August 1972 and the Advanced Thermal Control Flight Experiment (ATFE) is scheduled for launch in May 1973. The major efforts of the technology development, initial flight results of the AHPE, and ground test data of the ATFE are discussed. Author

N73-28918*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF AN ANNUAL COMBUSTOR DESIGNED FOR A LOW-COST TURBOJET ENGINE

James S. Fear Washington Aug. 1973 43 p refs
(NASA-TM-X-2857; E-7424) Avail: NTIS HC $3.00 CSCL 21E

Performance tests were conducted on a combustor designed for use in a low-cost turbojet engine. Low-cost features included the use of very inexpensive simplex fuel nozzles and combustor liners of perforated sheet material. Combustion efficiencies at the altitude-cruise and sea-level design points were approximately 94 and 96 percent, respectively. The combustor isothermal total-pressure loss was 8.8 percent at the altitude-cruise-condition diffuser-inlet Mach number of 0.335. The combustor-exit temperature pattern factor was less than 0.3 at the altitude-cruise, sea-level-cruise, and sea-level-static design conditions. The combustor-exit average radial temperature profiles at all conditions were in very good agreement with the design profile. The intense mixing required because of the very high combustor heat-release rate had an adverse effect on ignition capability at altitude windmilling design conditions. Author

N73-28919*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AFTERBURNER PERFORMANCE OF FILM-VAPORIZING V-GUTTERS FOR INLET TEMPERATURES UP TO 1255 K

J. Robert Branstetter and Gregory M. Reck Washington Aug. 1973 26 p refs
(NASA-TM-X-2855; E-7435) Avail: NTIS HC $3.00 CSCL 21B

Combustion tests of five variations of an integral, spray-bar-flameholder combination were conducted in a 0.49-m-diameter duct. Emphasis was on low levels of augmentation. Fuel impinged on guide plates, mixed with a controlled amount of inlet air, vaporized, and was guided into the V-gutter wake. Combustor length was 0.92 m. Good performance was demonstrated at fuel-air ratios less than 0.025 for inlet temperatures of 920 to 1255 K. Maximum combustion efficiency occured in the vicinity of fuel-air ratios of 0.02 and was 92 to 100 percent, depending on the inlet temperature. Lean blowout fuel-air ratios were in the vicinity of 0.005. Improvements in rich-limit blowout resulted from enlarging the guide-flow passageway areas. Other means of extending the operating range are suggested. A simplified afterburner concept for application to advanced engines is described. Author

N73-28920*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DESIGN AND TESTING OF A PASSIVE, FEEDBACK-CONTROLLED, VARIABLE CONDUCTANCE HEAT PIPE

K. R. Schlitt Aug. 1973 16 p refs Sponsored in part by NAS-NRC
(NASA-TM-X-62293) Avail: NTIS HC $3.00 CSCL 20M

A passive feedback system, which stabilizes the heat source temperature (T sub s) of a gas loaded heat pipe, was designed and tested. The control of T sub s is accomplished by an auxiliary liquid that senses the heat source and actuates a metal bellows system due to the liquid's thermal expansion. The movement of the bellows varies the gas reservoir volume and leads to a corresponding change of the condensation area of the heat pipe. With methanol as the heat pipe working fluid and perfluoro-n-pentane as the auxiliary liquid, the control capability was found to be T sub s = 31.5 + or - 1.5 C in a power range from 3 to 30 W, compared to T sub s = 33 + or - 3 C with methanol as auxiliary liquid. The change in T sub s was 35 + or - 5.5 C with the bellows held in the closed position. Author

N73-28921*# General Electric Co., Utica, N.Y. Aerospace Electronic Systems Dept.

AN EFFICIENT NUMERICAL TECHNIQUE FOR CALCULATING THERMAL SPREADING RESISTANCE Final Report

Earl H. Gale, Jr. 8 Feb. 1973 84 p refs
(Contract NAS8-28516)
(NASA-CR-124312) Avail: NTIS HC $6.25 CSCL 20M

The results of a thermal spreading resistance data generation technique study are reported. The method developed is discussed in detail, illustrative examples given, and the resulting computer program is included. Author

N73-28922*# Wyle Labs., Inc., Huntsville, Ala.

PREDICTION OF FLUCTUATING PRESSURE ENVIRONMENTS ASSOCIATED WITH PLUME-INDUCED SEPARATED FLOW FIELDS

Kenneth J. Plotkin May 1973 87 p refs
(Contract NAS8-26919)
(NASA-CR-124346; WR-73-3) Avail: NTIS HC $6.50 CSCL 20D

The separated flow environment induced by underexpanded rocket plumes during boost phase of rocket vehicles has been investigated. A simple semi-empirical model for predicting the extent of separation was developed. This model offers considerable computational economy as compared to other schemes reported in the literature, and has been shown to be in good agreement with limited flight data. The unsteady pressure field in plume-induced separated regions was investigated. It was found that fluctuations differed from those for a rigid flare only at low frequencies. The major difference between plume-induced separation and flare-induced separation was shown to be an increase in shock oscillation distance for the plume case. The

prediction schemes were applied to PRR shuttle launch configuration. It was found that fluctuating pressures from plume-induced separation are not as severe as for other fluctuating environments at the critical flight condition of maximum dynamic pressure.
Author

N73-28923# Institut Franco-Allemand de Recherches, St. Louis (France).
BIBLIOGRAPHIC AND CRITICAL ANALYSIS OF STUDIES OF SECONDARY SOLID EXPLOSIVES' SENSITIVITY TO SHOCK WAVES [ANALYSE BIBLIOGRAPHIQUE ET CRITIQUE DES ETUDES DE SENSIBILITE A L'ONDE DE CHOC DES EXPLOSIFS SECONDAIRES CONDENSES]
C. Fauquignon and Y. DeLongueville 4 Jan. 1973 32 p refs In FRENCH
(Contract SNPE-18/72/D)
(ISL-2/73) Avail: NTIS HC $3.75

Work carried out on the sensitivity of explosives to shock waves is analyzed. The influence of various physical and chemical parameters related to the explosive is discussed, and the need for characterizing pressure and duration of the shock is emphasized. The energy-threshold notion is analyzed. ESRO

N73-28924# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
MEASUREMENT OF IONIC CONDUCTIVITY AND TEMPERATURE IN THE APOLLO 15 PLUME
John L. Heckscher and Robert P. Pagliarulo 26 Jun. 1973 29 p refs
(AD-761484; AFCRL-TR-73-0124; AFCRL-PSRP-539) Avail: NTIS CSCL 22/4

Positive ion conductivity and temperature of plume gases enveloping the top of the launcher umbilical tower (LUT) were monitored during the launch of Apollo 15. The measurements are presented along with the orientation of the rocket plume relative to the instrumentation. Details and limitations of the apparatus are described, and the calibration techniques are given. Author (GRA)

N73-28925# Illinois Univ., Urbana.
COMBUSTION AND FLAME STABILITY Final Report, 4 Nov. 1965 - 30 Nov. 1972
Roger A. Schmitz 1 Jun. 1973 36 p refs
(Grants DA-ARO(D)-31-124-G727; DA-ARO(D)-31-124-G1105)
(AD-762360; AROD-5648-10-E) Avail: NTIS CSCL 21/2

The major portion of the research briefly described in this report involved the use of methods of mathematical analysis and computer simulations to elucidate behavioral features of open combustion processes, particularly transient characteristics. Mathematical models of various types of systems were studied, invluding well-mixed combustors, diffusion flames, surface reactions, and reacting boundary-layer flows. Principal results include the discovery of instabilities and other transient characteristics, not previously recognized, which are important in the prediction and understanding of ignition and extinction phenomena. Situations in which instabilities lead to sustained oscillations were also studied, and some comparisons of results of laboratory experiments with theoretical predictions for a premixed combustible mixture in stagnation flow were possible.
Author (GRA)

N73-28926# Army Foreign Science and Technology Center, Charlottesville, Va.
COMPARATIVE EVALUATION OF METHODS OF MEASUREMENT OF ACTIVE RESISTANCE OF THERMOELECTRIC HEATING AND COOLING DEVICES
N. O. Skuratovskii and V. F. Mikheev 2 Nov. 1972 5 p refs Transl. into ENGLISH from Geliotekh., Akad. Nauk Uzb. SSR (USSR), no. 5, 1970 p 67-69
(AD-762324; FSTC-HT-23-1006-72) Avail: NTIS CSCL 13/1

The two methods for determining of thermoelectric cooling and heating devices pure resistance are presented and compared. One of them is based on the alternating current bridge measurement. Another method, using a principle of a unidirectional voltage harmonious component distribution between the thermoelectric apparatus under test and the standard device, having a low resistance, provides a pure resistance value with the help of an electronic voltmeter at the working current during the process of heat and cold production. Author

N73-28927# Army Foreign Science and Technology Center, Charlottesville, Va.
CONVECTIVE HEAT TRANSFER IN THE PRESSURE OF HETEROGENEOUS CATALYTIC REACTIONS
V. P. Motulovich 1 Mar. 1973 11 p refs Transl. into ENGLISH from Nauka i Tekhn. (Minsk), 1968 p 149-158
(AD-761607; FSTC-HT-23-1496-72) Avail: NTIS CSCL 07/4

In a number of cases presenting a practical interest, heat exchange between a liquid and bodies on which it overflows and on the surface of which chemical reactions of a catalytic type develope, plays an essential part. The present work is devoted to the theoretical and experimental investigation of this process.
GRA

N73-28928# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
THEORY OF FLAME FRONT PROPAGATION IN POROUS PROPELLANT CHARGES UNDER CONFINEMENT
Kenneth Kuan-Yun Kuo, R. Vichnevetsky, and Martin Summerfield Aug. 1971 170 p refs
(Contract N00014-67-A-0151-0023)
(AD-762063; AMS-1000) Avail: NTIS CSCL 21/2

Ultra-high burning rates can be achieved by combustion of porous media. A theoretical model is developed to describe the flame propagation in a packed bed of granular propellant. The calculated pressure-time-distance transients, wave propagation speed, and mass fraction of propellant burned during flame propagation, all agree well with experimental data obtained for the same conditions. Results demonstrate that the combustion-generated strong pressure gradient causes the hot product gas to deeply penetrate the unburned region. A continental divide forms automatically in the pressure distribution as the wave progresses into the charge. In the particular case studied the flame front reaches a speed about 5000 times the normal propellant burning rate and continues to accelerate as the internal pressure increases. (Modified Author Abstract) GRA

N73-28929# Naval Ordnance Lab., White Oak, Md.
COMPUTATION OF THE SKIN FRICTION AND HEAT TRANSFER ON A SHARP CONE IN AXISYMMETRIC TURBULENT HYPERSONIC FLOW
Stephen Sacks 12 Apr. 1973 18 p refs
(AD-761602; NOLTR-73-79) Avail: NTIS CSCL 16/3

A computer program has been written to determine the skin-friction coefficient and heat-transfer rate on a sharp cone in axisymmetric hypersonic flow with a turbulent boundary layer. The methods of Spalding and Chi, Sommer and Short, and Van Driest transformations between the incompressible and compressible planes. The Karman-Schoenherr flat plate equation is used to relate the incompressible skin friction to Reynolds number based on momentum thickness. A listing of the program is also included in the report. Author (GRA)

N73-28930# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
THE STRUCTURE OF MULTIPLE DIFFUSION FLAMES FOR A TWO STEP CHAIN REACTION
Francis E. Fendell (Calif. Univ., San Diego) and William B. Bush (TRW Systems Group, Redondo Beach, Calif.) Apr. 1973 64 p refs
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-762459; SQUID-TR-TRW-6-PU) Avail: NTIS CSCL 21/2

The low speed deflagration of initially unmixed gaseous reactants under an irreversible two-step chain reaction is examined. Both equilibrium burning, in which two separated flames of zero thickness arise, and near-equilibrium burning, in which two spatially separated flames of small but finite thickness arise, are studied by limit process expansion techniques. Two time-dependent two-dimensional flows are examined: the first is diffusion flow; and the second is counter stagnation flow. The latter flow, in which there is an impressed finite strain parallel to the flame, such that the flame, itself, is longitudinally stretched, is discussed as elucidating the characteristics of combustion in turbulent shear flows. Author (GRA)

N73-28931# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DETECTION OF CENTERS OF COMBUSTION OF SMALL DIMENSIONS BY THE METHOD FOR IR PHOTOGRAPHY
V. I. Binenko, L. N. Dyachenko, K. Ya. Kondratev, and A. P. Chernenko 25 May 1973 18 p refs Transl. into ENGLISH from Radiatsionnye Issled. v Atmosfere (USSR), no. 275, 1972 p 226-236
(AD-762265; FTD-MT-24-1867-72) Avail: NTIS CSCL 17/5

The need for seeking a new, reliable method which makes it possible to detect centers of combustion in forest fires in early stages of their development is well known. Such a method can become the method of infrared photography from aircraft. The purpose of the report is to evaluate the possibilities of using infrared scanning equipment for the detection of centers of combustion of small dimensions. GRA

N73-28932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BURNING OF ALUMINUM IN THE COMPOSITION OF HETEROGENEOUS CONDENSED SYSTEMS
Yu. V. Krolov, A. I. Korotkov, O. I. Leipunskii, and P. F. Pokhil 24 May 1973 16 p refs Transl. into ENGLISH from Fiz. Aerodispersnykh Sis. (USSR), no. 3, 1970 p 126-137
(AD-761609; FTD-MT-24-357-73) Avail: NTIS CSCL 21/2

The report discusses the burning of aluminum particles and discusses two proposed models. GRA

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N73-28933# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
[CONTINUING STUDIES IN AERODYNAMICS, LARGE WIND TUNNELS, ENERGETICS, PHYSICS, AND MATERIALS] 1972 Activities
1972 144 p refs
Avail: NTIS HC $9.25

After some general remarks on management and administrative problems, brief descriptions of activities of the systems, aerodynamics, Modane large wind tunnels, structures, energetics, physics, and materials departments are reported. Patents, published documents, and memoranda are listed. Author

N73-28934*# Kanner (Leo) Associates, Redwood City, Calif.
COLLISION CROSS SECTIONS BETWEEN OXYGEN MOLECULES AND LOW ENERGY ELECTRONS
Kazuo Takayanagi and Tan Takahashi Washington NASA Jul. 1973 43 p refs Transl. into ENGLISH from Daigaku Uchi Koku Kenkyusho hokoku (Tokyo), v. 3, no. 3, Jul. 1967 p 217-243
(Contract NASw-2481)
(NASA-TT-F-15011) Avail: NTIS HC $4.25 CSCL 20H

Available cross section data are reviewed for collision processes between molecular oxygen and electrons with collision energy below 100 eV. Elastic scattering, attachment, rotational and vibrational transitions, electronic excitation and ionization are considered. The experimental generalized oscillator strengths reported by Lassettre are used to calculate the Born cross section for some electronic excitation and ionization processes. Author

N73-28935# Committee on Appropriations (U. S. House).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS APPROPRIATIONS, 1974
Edward P. Boland Washington GPO 1973 9 p refs Rept. on H.R. 8825 by the Comm. of Conference on the disagreeing votes of the two Houses on the amendments of the Senate to the bill at the 93d Congr., 1st Sess., 27 Jul. 1973 Prepared in cooperation with Comm. on Appropriations (US Senate)
(H-Rept-91-316) Avail: US Capitol, House Document Room

The recommendations of the conference committee concerning the Senate admendments to H.R. 8825 are reported. The admendments include open space land programs, and assistance for health manpower training institutions. F.O.S.

N73-28936# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, SPACE, SCIENCE, VETERANS, AND CERTAIN OTHER INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1974. SPACE SHUTTLE AND ALTERNATE PROGRAMS: GAO ANALYSIS OF COST ESTIMATES
Washington GPO 1973 31 p Hearing on HR. 8825 before Comm. on Appropriations, 93d Congr., 1st Sess., 12 Jun. 1973
Avail: Comm. on Appropriations

The hearings are reported concerning the GAO cost analysis of NASA estimates for the space shuttle and two alternate expendable systems. Topics discussed include: economic justification for the space shuttle, payload factors, cost of current expendable system, cost of new expendable system, drop tanks, shuttle launch costs, shuttle savings projected to year 2000, mission models, and NASA history with cost overruns. F.O.S.

N73-28937*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE PROJECT MANAGEMENT ROLE IN SAFETY
R. C. Callaway 20 Jul. 1973 28 p refs
(NASA-TM-X-64764) Avail: NTIS HC $3.50 CSCL 13L

Techniques to be utilized by project management in the planning, implementation, and administration of a project safety program are presented. Safety functional responsibilities are classified into two categories: safety management and safety engineering. The emphasis is on the safety management role, and how safety activities are to be integrated throughout the project and made visible in the work breakdown structure and cost accounting and reporting. Safety inputs into the RFP, contractor program plans, etc., constitute an effective method of safety achievement. Author

N73-28938# National Science Foundation, Washington, D.C.
IMMIGRANT SCIENTISTS AND ENGINEERS IN THE UNITED STATES: A STUDY OF CHARACTERISTICS AND ATTITUDES
Feb. 1973 109 p refs
Avail: SOD $1.25 Domestic Postpaid or $1.00 GPO Bookstore

A survey is presented of alien scientists and engineers who were permanent U.S. residents in January 1969. The survey indicates: (1) Scientists and engineers immigrate to the United States most often seeking a higher standard of living, however, the primary reasons for emigration vary by individual country of birth. For example, the political environment is by far the most important reason for Cuban emigration. (2) About 60% of the immigrants had been in the United States on a temporary visa before becomming immigrants. (3) In mid-1970, 28% of the immigrants held doctoral degrees and another 29% had master's degrees. About one in five were enrolled in full- or part-time graduate training. (4) At the time of the survey, 91% of the foreign scientists and engineers were employed full time professionally, and 3% were unemployed. (5) Over one-half of the immigrants were in research or development. (6) Private industry employed 77% and colleges and universities about 13%. (7) Fully 37% had been contacted by foreign employers for remigration. F.O.S.

N73-28939# National Science Foundation, Washington, D.C. National Science Board
SCIENCE INDICATORS, 1972 Annual Report No. 5
1973 150 p refs Submitted to the President of the United States, 31 Jan. 1973, in accordance with Section 4(g) of National Science Foundation Act as amended by Public Act 90-407
(NSB73-1; AR-5) Avail: SOD $3.35 Domestic Postpaid or $3.00 GPO Bookstore

A system of indicators for describing the state of science in the United States was developed for setting priorities in allocating resources. The indicators range from measures of basic research activity and industrial R and D to productivity and the U.S. balance of trade. The position and performance of science and technology in the U.S. is compared with that of other major R and D performing nations through a variety of indicators. Indicators

discussed include: financial and human resources employed in R an D, basic research, growth of the national pool of scientists and engineers, and institutional capabilities. A Delphi experiment is also described. F.O.S.

N73-28940# RAND Corp., New York.
OPTIMAL DISPATCHING OF AN INFINITE CAPACITY SHUTTLE: CONTROL AT A SINGLE TERMINAL
Edward Ignall (Columbia Univ., N. Y.) and Peter Kolesar Mar. 1973 36 p refs
(P-4979) Avail: NTIS HC $4.00

The optimal control is studied of a shuttle system consisting of a single infinite capacity carrier transporting passengers between two terminals. Passengers arrive according to independent Poisson processes, and dispatching decisions to hold the carrier for more passengers can be made at only one of the terminals. The objective is minimization of the long-run average of a linear passenger waiting cost and a fixed charge per trip made. When complete information about the system state is available, and travel times are deterministic, it is proved that it is optimal to dispatch the carrier if, and only if, the total number of passengers waiting at both terminals is greater than a cutoff value. An iterative method for computation of the cutoff value is given and it is shown that it can be well approximated by a function of system costs and parameters similar to the economic lot size formula. A (possibly nonoptimal) dispatching rule is proposed for the case when only the number of passengers waiting at one terminal is known, and its efficiency is compared to that of the optimal rule. Extensions to other optimality criteria and to the case of stochastic travel times are outlined. Author

N73-28941*# National Aeronautics and Space Administration, Washington, D.C.
INDEX TO NASA TECH BRIEFS, 1972
Feb. 1973 202 p refs
(NASA-SP-5021(13)) Avail: NTIS HC $3.00 CSCL 05B

Abstracts of 1972 NASA Tech Briefs are presented. Four indexes are included: subject, personal author, originating center, and Tech Brief number. Author.

N73-28942*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. Inst. of Governmental Studies.
THE SOCIAL IMPACTS OF TECHNOLOGY: TOWARD AN ASSESSMENT OF STOL AIRCRAFT POTENTIAL Semiannual Report, 1 Dec. 1972 - 30 May 1973
Todd R. LaPorte 30 May 1973 26 p ref
(Grant NGR-05-003-0471)
(NASA-CR-133356) Avail: NTIS HC $3.50 CSCL 05K

Progress of the work done on STOL assessment relating to (1) the mobility and social change aspect of research and (2) analysis of data relating to public attitudes toward technology outlined. Author

N73-28943*# IIT Research Inst., Chicago, Ill. Management and Social Science Research.
TECHNOLOGY TRANSFER TO A DEVELOPING NATION, KOREA Final Report
C. A. Stone and S. J. Uccetta Jul. 1973 90 p refs
(Contract NASw-2083)
(NASA-CR-133359) Avail: NTIS HC $6.50 CSCL 05B

An experimental project is reported which was undertaken. to determine if selected types of technology developed for the aerospace program during the past decade are relevant to specific industrial problems of a developing nation and to test whether a structured program could facilitate the transfer of relevant technologies. The Korea Institute of Science and Technology and the IIT Research Institute were selected as the active transfer agents to participate in the program. The pilot project was based upon the approach to the transfer of domestic technology developed by the NASA Technology Utilization Division and utilized the extensive data and technical resources available through the Space Agency and its contractors. This pilot project has helped to clarify some aspects of the international technology transfer process and to upgrade Korean technological capabilities. Author

N73-28944# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics.
STRATEGY OF SPACE RESEARCH
H. Alfven 1972 10 p Presented at the Lomonosov Meeting, Moscow, Mar. 1972
(TRITA-EPP-72-08) Avail: NTIS HC $3.00

Comments are made on three different aspects of space research. Firstly in space technology where new methods of propulsion are considered, especially plasma and solar wind. Secondly in manned space flight and finally in the space sciences where the evolution of the solar system is discussed. ESRO

N73-28945# Naval Postgraduate School, Monterey, Calif.
ALLOCATION OF RESEARCH LABORATORY RESOURCES: A STUDY OF RESOURCES ALLOCATION USING CRITERIA OF MILITARY SIGNIFICANCE AND INVESTMENT RISK M.S. Thesis
Warren James Millard Mar. 1973 62 p refs
(AD-761392) Avail: NTIS CSCL 12/2

The problem is defined as examining a list of the research projects presently sponsored by the Department of the Navy under GOR-43 and analyze the ordered project listings as ranked by panels composed of persons with interest in those projects. Data consisted of project priority rankings of 193 judges composing 9 separate panels, each judge ranking the projects twice in priority order; once considering the practical significance of the project and once considering the possibility of a successful research effort. Project rankings of judges within each panel were scaled using the FORD procedure and the 9 panel rankings then investigated for similarities using methods of cluster analysis. (Modified Author Abstract) GRA

N73-28946# Naval Postgraduate School, Monterey, Calif.
A STATISTICAL ANALYSIS OF DEVIATIONS FROM TARGET COST IN NAVAIRSYSCOMHQ FIXED-PRICE INCENTIVE CONTRACTS DURING THE 1949-1965 TIME FRAME M.S. Thesis
Wayne Dixon Mar. 1973 58 p refs
(AD-761396) Avail: NTIS CSCL 15/5

The paper statistically analyzes 15 years of Naval Air Systems Command Headquarters fixed-price incentive contract experience in the aircraft and missile procurement field. The relation of basic contract parameters to contract outcome is explored through regression and analysis of variance techniques. The inferences arising from the statistical analysis are combined with other information to draw conclusions regarding incentive contracting. The most important of these is that there is no evidence that the negotiated sharing ratio has any influence on the contractor during the performance of the contract. Author (GRA)

N73-28947# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
MAINTENANCE SCHEDULING LIMITATIONS
Joseph E. Boyett, Jr. 24 Apr. 1973 26 p
(AD-761494; AU-AFIT-SL-2-73) Avail: NTIS CSCL 15/5

The paper discusses maintenance scheduling problems which must be resolved during phase 2 of the STALOG development. Performance measures associated with scheduling are identified as being extremely critical since they must be clearly established prior to developing specific scheduling techniques. A brief review of sequencing techniques allows the reader to visualize how different heuristics might be used in a dispatching model developed for specific applications. Recommendations are tentative since very little research has been conducted on complex problems of this type. Author (GRA)

N73-28948# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
AFCRL FISCAL YEAR 1974, AIR FORCE TECHNICAL OBJECTIVE DOCUMENT
2 Apr. 1973 64 p
(AD-761483; AFCRL-TR-73-0211; AFCRL-SR-158) Avail: NTIS CSCL 04/1

The report describes fifteen Technical Planning Objectives in environmental and electromagnetic technologies. The environmental areas of concern include meteorology, optical/infrared physics, aeronomy and ionospheric physics, solar and space physics, and the earth sciences. The electromagnetic technologies cover

microwave propagation, equipment and techniques, and electronic and electro-optical materials and devices. These Technical Planning Objectives constitute the Air Force Cambridge Research Laboratories Fiscal Year 1974 Technical Objective Document. This document supersedes TODs 71-31, 71-39, 71-40, and 71-41. Author (GRA)

N73-28949# Army War Coll., Carlisle Barracks, Pa.
BURDENSOME PROCEDURES INVOLVED IN AWARDING RESEARCH AND DEVELOPMENT CONTRACTS
Howard K. Hostler 7 Mar. 1973 27 p refs
(AD-761443) Avail: NTIS CSCL 15/5

The article briefly examines Department of Defense (DOD) and the US Army's new weapons systems acquisition policies and guidelines. It appears that the new DOD guidelines will increase the time that elapses between the inception of a Required Operational Capability (ROC), and the resulting availability of a new weapon system. Therefore, the source selection process, which is a significant part of the acquisition system, is examined in detail. The process is made to: (1) determine if it is burdensome and time-consuming, and (2) make recommendations for improving the process. (Modified Author Abstract) GRA

N73-28950# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
AIR FORCE FLIGHT DYNAMICS LABORATORY FISCAL YEAR 1974 TECHNICAL OBJECTIVE DOCUMENT
Apr. 1973 98 p
(AD-762300; AFFDL-TR-73-41) Avail: NTIS CSCL 01/3

The technology planning objectives and supporting technical goals for the research and development activities of the Air Force Flight Dynamics Laboratory during Fisical Year 1974 are presented. The planning objectives are described for flight vehicle structures, aircraft systems, flight control, flight mechanics, and technology integration. Cross references to specific organizations and individuals are provided for clarity. Author

N73-28951# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
A HIERARCHY OF OBJECTIVES AND RELATED PERFORMANCE INDICATORS FOR AIRCRAFT MAINTENANCE ORGANIZATIONS. M.S. Thesis
Larry L. Ullrey and Clark R. Penas 15 Sep. 1972 176 p refs
(AD-762270; SLSR-18-72) Avail: NTIS CSCL 01/3

There were three main objectives which the authors intended to accomplish in the thesis. The first thesis objective was to formulate the hierarchy of maintenance objectives by determining the primary objective of the base level aircraft maintenance organization and the subordinate objective which must be achieved prior to the achievement of the primary maintenance objective. The second thesis objective was to identify those measurable performance indicators that would permit maintenance managers to monitor, via the exception principle, progress toward the accomplishment of the maintenance objectives. The third and final thesis objective was to establish the frequency with which the identified performance indicators should be observed to insure timely correction of out-of-tolerance performance. GRA

N73-28952# California Univ., La Jolla. Inst. for Pure and Applied Physical Sciences.
RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS Final Report, 30 Jun. 1964 - 31 Dec. 1972
K. A. Brueckner, S. S. Penner, D. B. Olfe, F. A. Williams, and S. C. Lin 31 Dec. 1972 43 p refs
(Contract DA-31-124-ARO(D)-257; ARPA Order 570)
(AD-761633; AROD-5133-395-P) Avail: NTIS CSCL 05/2

The report contains a list of publications submitted under the contract. GRA

N73-28953# Battelle Columbus Labs., Ohio.
MINIATURE, REMOTELY CONTROLLED LAND AND WATER VEHICLES
W. S. Pope, D. C. Doerschuk, and J. M. Tierney Jul. 1972 158 p refs
(Contract F33657-71-C-0893; ARPA Order 1541)
(AD-761665; A-3963) Avail: NTIS CSCL 15/3

The report includes a technical assessment of selected vehicles and systems; a summary of the results of a conference on miniature, remotely controlled vehicles held at Battelle, and conclusions and recommendations with respect to miniature-vehicle technology. The objectives of the program were to conduct a survey of existing, developmental, and conceptual miniature, R/C land and water vehicles and their associated components, and to perform a technical assessment of the vehicles identified in the survey to assist interested agencies in determining which vehicles are potentially useful for their specific missions, and what actions might be necessary to modify an existing vehicle to perform as required. GRA

N73-28954# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ROCKET AND THE NUCLEAR EXPLOSION
V. Malikov 24 May 1973 12 p Transl. into ENGLISH from the monograph "Fizika v Boyu" 1967 p 37-47
(AD-761577; FTD-MT-24-335-73) Avail: NTIS CSCL 15/3

The report presents a cursory review of shock absorbing systems used by the United States in guided missile silos. GRA

N73-28955# Informatics, Inc., Rockville, Md.
SELECTED MATERIAL FROM SOVIET TECHNICAL LITERATURE, MARCH 1973
Stuart G. Hibben 22 May 1973 202 p
(Contract F44620-72-C-0053; ARPA Order 1622-4)
(AD-762376; AFOSR-73-1041TR) Avail: NTIS CSCL 05/2

The report includes abstracts and bibliographic lists on contractual subjects that were completed in March 1973. The major topics are laser technology, effects of strong explosions, geosciences, particle beams and material sciences. A section on miscellaneous interest is also included. A report on a Soviet tunneling rocket was published separately as the March optional topic. Laser coverage is generally limited to high power effects. All current laser material is routinely entered in the quarterly laser bibliographies. An index identifying source abbreviations and a first-author index to the abstracts are appended. Author (GRA)

N73-28956# Vector Research, Inc., Ann Arbor, Mich.
ANALYTIC MODELS OF AIR CAVALRY COMBAT OPERATIONS, VOLUME 1 Final Report
May 1973 141 p
(Contract DAAG25-71-C-0407)
(AD-762432; SAG-1-Vol-1; FR-73-1-Vol-1) Avail: NTIS CSCL 15/7

This is the first of two volumes reporting the research activities on analytic modeling of air cavalry combat. The volume contains an introduction to and summary of the research and modeling performed, a summary description of the differential models of attack helicopters supporting a battalion task force (which are fully documented in Volume II), and a description of the stochastic models of attack helicopters independently attacking ground targets, the program implementing these models, and a sample run of the program. (Modified Author Abstract) GRA

N73-28957# Vector Research, Inc., Ann Arbor, Mich.
ANALYTIC MODELS OF AIR CAVALRY COMBAT OPERATIONS, VOLUME 2 Final Report
May 1973 657 p refs
(Contract DAAG25-71-C-0407)
(AD-762433; SAG-1-Vol-2; FR-73-1-Vol-2) Avail: NTIS CSCL 15/7

This is the second of two volumes reporting the research activities on analytic modeling of air cavalry combat. The volume describes the work done in including attack helicopters and air defense weapons in the differential models of battalion task force combat. It includes a review of the basic mathematical structure of the differential combat models, complete descriptions of the mathematical models used to describe the activities and effects of attack helicopters and air defense weapons within the models, a review of the IUA versions of the models and the associated computer programs, and a complete programmer's guide to the augmented battalion task force programs. (Modified Author Abstract) GRA

N73-28958# Sacramento Air Materiel Area, McClellan AFB, Calif.
LOGISTIC PERFORMANCE DATA BOOK FOR F-111A

AIRFRAME SYSTEM
Jack F. Bussio Mar. 1973 154 p refs
(AD-762213; F-111-A-11000/73-13) Avail: NTIS CSCL 15/5

The principal purpose of the report is to impart sufficient Logistics Support Cost history on the F-111A Airframe System to a design engineer of a similar functional capability to permit technical analysis of the good and bad design features of that system. The report contains four sections: AFLC organizations/ personnel knowledgeable, Logistic Support cost by component, reliability/maintainability summary, and problem history narrative. Author (GRA)

N73-28959# Sacramento Air Materiel Area, McClellan AFB, Calif.
LOGISTIC PERFORMANCE DATA BOOK FOR F-111D BOMB NAVIGATION MARK 2 AVIONICS
Jack F. Bussio Mar. 1973 144 p refs
(AD-762214; F-111-D-73000/73-14) Avail: NTIS CSCL 15/5

The principal purpose of the report is to impart sufficient logistics support cost history on the F-111D Bomb Navigation Mark 2 avionics to a design engineer of a similar functional capability to permit technical analysis of the good and bad design features of that system. The report contains four sections: AFLC organizations/personnel knowledgeable, logistic support cost by component, reliability/maintainability/summary and problem history narrative. Author (GRA)

N73-28960# Oklahoma City Air Materiel Area, Tinker AFB, Okla.
LOGISTIC PERFORMANCE DATA BOOK FOR A-7D BOMB NAVIGATION SYSTEM
Mar. 1973 84 p refs
(AD-762215; A-7D-73000/73-1) Avail: NTIS CSCL 15/5

The report presents the reliability, maintainability, logistic support cost, and general product performance information on the A-7D bomb navigation system. It's purpose is to impart sufficient logistics support history on the bomb navigation system to the engineering/design community represented by AFSC and the contractors engaged in the design of similar systems/ sub-systems for Air Force use. Author (GRA)

N73-28961# Oklahoma City Air Materiel Area, Tinker AFB, Okla.
LOGISTIC PERFORMANCE DATA BOOK FOR B-52G ELECTRONIC COUNTERMEASURES SYSTEM
Mar. 1973 109 p
(AD-762216; B-52G-76000) Avail: NTIS CSCL 15/5

The document presents the reliability, maintainability, logistic support cost, and general product performance information on the B-52G electronic countermeasures system. Its purpose is to impart sufficient logistics support history on the electronic countermeasures system to the engineering/ design community represented by AFSC and the contractors engaged in the design of similar systems/ sub-systems for Air Force use.
Author (GRA)

N73-28962# Oklahoma City Air Materiel Area, Tinker AFB, Okla.
LOGISTIC PERFORMANCE DATA BOOK FOR KC-135 PROPULSION SYSTEM
Mar. 1973 194 p refs
(AD-762217; KC-135-23000/73-2) Avail: NTIS CSCL 15/5

The report presents the reliability, maintainability, logistic support cost, and general product performance information on the KC-135 propulsion system. Its purpose is to impart sufficient logistics support history on the propulsion system to the Engineering/design community represented by AFSC and the contractors engaged in the design of similar systems/sub-systems for Air Force use. Author (GRA)

N73-28963# San Antonio Air Materiel Area, Kelly AFB, Tex.
LOGISTIC PERFORMANCE DATA BOOK FOR C-5A LANDING GEAR SYSTEM Summary Report, Mar. 1966 - Dec. 1972
Choice O. Harper Dec. 1972 321 p refs
(AD-762248; C-5A-13000/73-6) Avail: NTIS CSCL 01/3

The purpose of the report is to transmit C-5A landing gear system reliability, maintainability, logistic support cost and general performance information from the Air Force Logistic Command (AFLC) to the engineering/design community represented by the Air Force System Command and the contractors engaged in the design of systems, subsystems, equipment, and components for Air Force use. The book is divided into four sections. Section A provides a listing of the AFLC organizations and personnel most knowledgeable of the book. Section B provides logistic support costs for every work unit code contained in the airframe system. Section C provides twelve months of Maintainability Reliability Summaries by work unit code on components experiencing one or more maintenance action in 1000 flight hours. Section D provides a synopsis of problems encountered on the landing gear system during the testing and operations phase through 28 February 1973. (Modified Author Abstract) GRA

N73-28964# Warner Robins Air Materiel Area, Robins AFB, Ga.
LOGISTIC PERFORMANCE DATA BOOK FOR C-130E PROPULSION SYSTEM Final Report
Albert L. Garnto Mar. 1973 136 p refs
(AD-762249; WRAMA-C-130E-22000/73-7) Avail: NTIS CSCL 21/5

The Logistic Performance Data Book provides reliability, maintainability, logistic support cost, and general performance information on the C-130E aircraft propulsion system. This historical type data was prepared for the use of Government agencies and contractors who design and manufacture aircraft engine propulsion systems. It is the intent by submitting this data to permit a technical analysis of good and bad design features of engines and thus influence and cause improvement in design of subsequent aircraft engines to be utilized by the United States Air Force. Author (GRA)

N73-28965# Warner Robins Air Materiel Area, Robins AFB, Ga.
LOGISTIC PERFORMANCE DATA BOOK FOR UH-1F AIRFRAME SYSTEM Final Report
George L. Jones Mar. 1973 120 p refs
(AD-762251; WRAMA-UH-1F-11000/73-15) Avail: NTIS CSCL 15/5

The Logistic Performance Data Book provides reliability, maintainability, logistic support cost, and general performance information on the UH-1F Helicopter Airframe System. This historical type data has been prepared for the use of Government agencies and contractors who design and manufacture aircraft and helicopter airframes. It is the intent by submitting this data to permit a technical analysis of good and bad design features of airframes and thus influence and cause improvement in design of subsequent airframe structures to be utilized by the United States Air Force. Author (GRA)

N73-28966# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
FAILURE-RATE PREDICTION AND WEAROUT DETECTION
Carl M. Harris, William G. Marchal, and Shelemyahu Zacks 11 May 1973 54 p refs
(Contract N00014-67-A-0214-0001; NR Proj. 347-020)
(AD-762417; Serial-T-282) Avail: NTIS CSCL 15/5

The paper is divided into four specific technical sections. The first presents two classical approaches to the detection of the commencement of wearout of a device, the primary one being the F technique. These methods are essentially ones for testing for constantness in the failure rate and as such can therefore also be used to detect the end of burn-in. The use of the F procedure is then illustrated on some Navy data. The second technical section presents a Bayes-type approach to the same problem and illustrates its use via a similated problem. The next two sections get back to more classical methods, with the first outlining some direct approaches to the estimation of the hazard-rate function itself, and the second indicating a simple method for incorporating the estimating procedure into the determination of an optimal economic replacement interval. (Modified Author Abstract) GRA

N73-28967# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AIR FORCE INSTITUTE OF TECHNOLOGY (AFIT) SCHOOL OF ENGINEERING CONTRIBUTIONS TO AIR FORCE RESEARCH AND TECHNOLOGY Technical Report, 1 Jan. - 31 Dec. 1971
Dec. 1972 51 p
(AD-762269; AFIT-TR-72-1; AU-1-72-AFIT/EN) Avail: NTIS CSCL 05/2

The report contains abstracts of Master of Science theses and Doctoral Dissertations completed during the 1971 calendar year at the School of Engineering, Air Force Institute of Technology. GRA

N73-28968# San Antonio Air Materiel Area, Kelly AFB, Tex. Directorate of Materiel Management.
LOGISTIC PERFORMANCE DATA BOOK FOR C-5A AIRFRAME SYSTEM Summary Report, Mar. 1966 - Dec. 1972
Choice O. Harper Dec. 1972 408 p
(AD-762233; C-5A-11000/73-5) Avail: NTIS CSCL 01/3

The purpose of the report is to transmit C-5A Airframe System reliability, maintainability, logistic support cost and general performance information from the Air Force Logistic Command (AFLC) to the Engineering/Design Community represented by the Air Force System and the contractors engaged in the design of systems, subsystems, equipment, and components for Air Force use. The book is divided into four sections. Section A provides a listing of the AFLC organizations and personnel most knowledgeable of the book. Section B provides logistic support costs for every work unit code contained in the airframe system. Section C provides twelve months of Maintainability Reliability Summaries by work unit code on components experiencing one or more maintenance action in 1000 flight hours. Section D provides a synopsis of problems encountered on the airframe system during the testing and operational phase through 28 February 1973. (Modified Author Abstract) GRA

N73-28969# Ogden Air Materiel Area, Hill AFB, Utah.
LOGISTIC PERFORMANCE DATA BOOK FOR F-4D FIRE CONTROL SYSTEM
Orin D. Hubbard 2 Apr. 1973 75 p refs
(AD-762229; F-4D-74000/73-9) Avail: NTIS CSCL 15/5

The data presented is based on the best available information and the purpose is to transmit the reliability, maintainability, logistic support cost and general performance information from the Air Force Logistic Command to the engineering/design community represented by the Air Force Logistic Command and the contractors engaged in the design of systems, sub-systems, equipment and components for Air Force use. The information is composed of logistic support costs for every work unit code contained in the subject sub-system. These costs are generated quarterly in the Increase Reliability Operational Systems (IROS) and are formatted to display average monthly support costs for a one-year period. (Modified Author Abstract) GRA

N73-28970# Ogden Air Materiel Area, Hill AFB, Utah.
LOGISTIC PERFORMANCE DATA BOOK FOR RF-4C LANDING GEAR SYSTEM
Orid D. Hubbard 2 Apr. 1973 114 p refs
(AD-762231; RF-4C-13000/73-11) Avail: NTIS CSCL 15/5

The data presented is based on the best available information and the purpose is to transmit the reliability, maintainability, logistic support cost and general performance information from the Air Force Logistic Command to the engineering/design community represented by the Air Force Logistic Command and the contractors engaged in the design of systems, sub-systems, equipment and components for Air Force use. The information is composed of logistic support costs for every work unit code contained in the subject sub-system. These costs are generated quarterly in the Increase Reliability Operational Systems (IROS) and are formatted to display average monthly support costs for a one-year period. (Modified Author Abstract) GRA

N73-28971# Warner Robins Air Materiel Area, Robins AFB, Ga. Directorate of Materiel Management.
LOGISTIC PERFORMANCE DATA BOOK FOR C-141A RADIO NAVIGATION SYSTEM Final Report
James R. King Mar. 1973 153 p
(AD-762250; WRAMA-C-141A-71000/73-8) Avail: NTIS CSCL 15/5

The Logistic Performance Data Book provides reliability, maintainability, logistic suppport cost, and general performance information on the C-141A Aircraft Radio Navigation System. This historical type data has been prepared for the use of Government agencies and contractors who design and manufacture Aircraft Radio Navigation Systems. It is the intent by submitting this data to permit a technical analysis of good and bad design features of equipment and thus influence and cause improvement in design of subsequent equipment to be used by the United States Air Force. Author (GRA)

N73-28972# Oklahoma City Air Materiel Area, Tinker AFB, Okla. Directorate of Materiel Management.
LOGISTIC PERFORMANCE DATA BOOK FOR KC-135 ELECTRICAL POWER SYSTEM Summary Report, Calendar Year 1972
Mar. 1973 110 p
(AD-762225; KC-135A-42000/73-3) Avail: NTIS CSCL 01/3

The document presents the relaibility, maintainability, logistic support cost, and general product performance information on the KC-135 electrical power system. Its purpose is to impart sufficient logistics support history on the electrical power system to the Engineering/Design Community represented by AFSC and the Contractors engaged in the design of similar systems/subsystems for Air Force use. Author (GRA)

N73-28973# Ogden Air Materiel Area, Hill AFB, Utah. Directorate of Materiel Management.
LOGISTIC PERFORMANCE DATA BOOK FOR F-4E FLIGHT CONTROL SYSTEM
Orin D. Hubbard 2 Apr. 1973 91 p refs
(AD-762230; F-4E-14000/73-10) Avail: NTIS CSCL 15/5

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N73-28974# Ogden Air Materiel Area, Hill AFB, Utah.
LOGISTIC PERFORMANCE DATA BOOK FOR RF-4C PHOTOGRAPHIC RECONNAISSANCE SYSTEM
Orin D. Hubbard 2 Apr. 1973 119 p
(AD-762232; RF-4C-77000/73-12) Avail: NTIS CSCL 15/5

The data presented is based on the best available information and the purpose is to transmit the reliability, maintainability, logistic support cost and general performance information from the Air Force Logistic Command to the Engineering/Design community represented by the Air Force Logistic Command and the contractors engaged in the design of systems, sub-systems, equipment and components for Air Force use. The information is composed of logistic support costs for every work unit code contained in the subject sub-system. These costs are generated quarterly in the Increase Reliability Operational Systems (IROS) and are formatted to display average monthly support costs for a one-year period. Maintainability/reliability summaries provide 12 months of data on the subject sub-systems, and is presented in work unit code sequence. These summaries are designed to present maintenance and failure rate data on items, sub-systems, and systems within a weapon. (Modified Author Abstract) GRA

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